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**A Journey with H. E. Engineer Kamal bin Ahmed  
President, Electricity and Water Authority (EWA)**

**Between the Engineering Ingenuity and Art of Management**

**Muharraq Ring Road and the  
Fourth Causeway Project**

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## In this Issue

### A Journey with H. E. Engineer Kamal bin Ahmed:

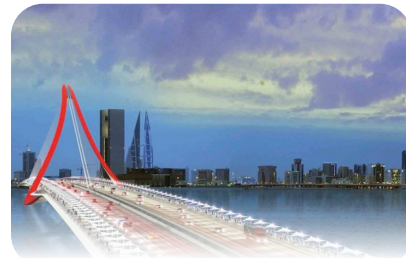
President, Electricity and Water Authority (EWA)

**Between the Engineering Ingenuity  
and Art of Management**



8

### Profile The Muharraq Ring Road and Fourth Causeway Project



20

### Strategic Project Management Through the Role of BSE's Project Management Association

Eng. A. Majeed Al Qassab



26

### Report on the Visit of the BSE Members to the Turkish TÜBİTAK Marmara Center



36



# Contents

▶ <b>Speech of the Editor-in-Chief</b> .....	6
▶ <b>A Journey with an Engineer</b> .....	8
H. E. Engineer Kamal bin Ahmed, President, Electricity and Water Authority (EWA)	
▶ <b>Profile</b> .....	20
Muharraq Ring Road and the Fourth Causeway Project .....	
▶ <b>Strategic Project Management Through the Role of BSE's Project Management Association</b> .....	26
▶ Eng. A. Majeed Al Qassab	
▶ <b>Articles</b> .....	30
▶ Magnetic Induction and Its Applications in Medicine: A Revolution in Diagnosis and Treatment, Eng. Yusuf Al Moamen .....	
▶ AI-Based Fuzzy Logic System for Precision Diabetes Risk Prediction, Dr. Walid El Fezzani .....	
▶ <b>BSE Youth</b> .....	35
Eng. Ali Jaber Al Qattan .....	
▶ <b>Report on BSE members' visit to TUBITAK Marmara Centre</b> .....	36
▶ <b>Students Projects</b> .....	38
▶ Solar Panel Auto Cleaning System .....	
▶ Design of smart DC/DC wall plug for the DC house .....	
▶ Design Standby Generator Panel to Supply Greenhouses Using Programmable Logic Controller .....	
▶ Real-Time Chemical Process Fault Detection Using Simulink and Aspen Dynamics .....	
▶ <b>Bahrain to Host the 8th Middle East Non-Destructive Testing (NDT) Conference and Exhibition 2025</b> .....	46

## Speech of the Editor-in-Chief



Professor Isa Qamber

ALMOHANDIS

The Bahrain Society of Engineers is consistently dedicated to investigating and acquiring projects or topics with relevance in fields that contribute to engineering advancement, including strategic projects aimed at developing and enhancing various engineering domains for sustainability. This effort contributes to the growth of the engineering sector in the Kingdom of Bahrain. Among the topics covered in this issue, one key focus is the use of renewable energy sources and pollution reduction to support sustainability. This initiative aids in the creation of long-term, efficient systems that future generations can benefit from. Such efforts highlight the importance of sustainable engineering, which strives to create a better engineered world.

This issue also features an interview with an engineer who has held multiple leadership positions, the latest of which is as the President of the Electricity and Water Authority (EWA) of the Kingdom of Bahrain, His Excellency Engineer Kamal bin Ahmed Mohammed. The Electricity and Water Authority (EWA) continually seeks to provide sustainable services to all citizens and residents in Bahrain according to the highest quality standards. This includes the implementation of several strategic projects aimed at achieving sustainability goals and delivering services efficiently and effectively, in line with global standards. One of His Excellency Engineer Kamal bin Ahmed Mohammed's key interests is Bahrain's hosting of conferences and workshops that reflect its ambitious vision to enhance regional and international cooperation in the energy sector and modern technologies, with a focus on strategies contributing to environmental and economic goals. Through our conversation with him, we gain a deeper understanding of this vision.

Turning to the main feature of this issue, the project aims to improve accessibility to neighboring villages (Hidd, Dair, Samaheej, Galali) and residential developments such as Amwaj, Dilmunia, and Diyar Al Muharraq. The project stretches from Al-Busaiteen to Diyar Al Muharraq.

It involves the construction of a four-lane road in each direction, spanning over 8 kilometers, with three traffic signal intersections, as well as secondary roads connecting adjacent areas. The project also includes the establishment of a rainwater drainage network and lift stations, alongside infrastructure works. Notably, the project aims to enhance traffic flow between Muharraq and Manama via a new 482-meter marine bridge with pedestrian and bicycle lanes. The project is part of the Bahraini government's strategy to develop infrastructure that supports sustainable economic growth and attracts investments. Additionally, a network of bridges will be built to improve connectivity between Muharraq and Manama. The project is divided into several phases, which are discussed in this issue. The main road was inaugurated in December 2024, with the remaining works expected to be completed in 2025.

The latest advancements in technology for providing a small-scale electricity source as an alternative to solar panels, particularly for smaller countries, are detailed in an article by Professor Isa Qamber. The new discovery involves the creation of small spherical devices that absorb light, ranging in size from one inch to four inches, making them thirty times smaller than solar panels. These spheres generate energy that surpasses the capacity of solar panels by up to 7.5 times. Developed by WAVJA in New York, these spheres absorb both natural and artificial light to generate electricity, outperforming solar panels in efficiency by more than 200 times. This technology, known as the "Photonic Energy System," relies on multiple layers of advanced materials within specialized spheres. This innovation offers an ideal solution for small nations like Bahrain, where

these small spheres can replace solar panels to generate electricity with high efficiency.

To improve the investment climate in the real estate sector, Bahrain needs to enhance the regulatory environment and streamline administrative procedures using "Administrative Engineering." This concept was discussed by Engineer Ibrahim Al-Burshid, who believes it is imperative for the Kingdom of Bahrain to establish an advanced environmental regulatory model, similar to Saudi Arabia's "Ettam" platform, which significantly reduced the time required for real estate transactions. The UAE launched the "Real Estate Dispute Resolution Center" in Dubai, which handles disputes efficiently and effectively. Bahrain has launched several digital initiatives to improve real estate services, such as the "e-Government

Portal". Additionally, regulating the rental market and protecting the rights of both tenants and landlords are critical factors for real estate stability. Bahrain can improve transparency by implementing an electronic registry for lease contracts, similar to Saudi Arabia's "EJARA" system. In conclusion, by adopting these innovative solutions, Bahrain can enhance its real estate sector, attract more investments, and support the long-term growth of the Bahraini economy.

Magnetic induction has contributed significantly to advancements in diagnostics and treatment in the medical field, a realization that has been facilitated by major developments in scientific innovation, particularly in medicine. Engineer Yusuf Al Moamen discussed how magnetic induction leads to the generation of electricity in a conductor due to changes in magnetic flux, a discovery made in the 19th century. This technology has broad applications in medicine, including magnetic resonance imaging (MRI), nerve stimulation, and magnetic therapy. These applications contribute to improved healthcare and the treatment of various medical conditions.

Dr. Walid El-Fezzani addressed diabetes as a global health issue affecting more than 500 million people. The new system, based on artificial intelligence, analyzes health factors to accurately determine the risk of developing diabetes with an accuracy rate of up to 87%. The system uses fuzzy logic to interpret unclear data, considering factors such as family history, body mass index (BMI), physical activity, diet, blood pressure, cholesterol, age, and smoking habits. The system has been tested and validated by endocrinologists in Tunisia and Bahrain. This system aids in early detection and reduces the burden on healthcare systems, ultimately contributing to improving

people's lives and achieving the United Nations' sustainable development goals of ensuring healthy lives for all.

Among the members of the Bahrain Society of Engineers is the young engineer Ali Jaber AlQattan, an emerging engineer in industrial automation in Bahrain. He was recently appointed as a SCADA Engineer at Aluminium Bahrain (Alba). At Kimberly-Clark, he led initiatives to improve production and product quality, while at Prudent Solutions, he led projects that transformed legacy systems into modern mechanisms.

Al Mohandis highlighted the visit of the BSE members to the TUBITAK Marmara Research Center in Turkey. This visit serves as an example of international professional partnerships for the Bahrain Society of Engineers, expanding collaborative frameworks with global institutions and supporting its vision to develop the engineering sector in Bahrain. During the visit, both parties discussed opportunities for joint collaboration and agreed on key areas such as training programs and workshops for the development of engineering skills, enhancing participation in engineering events, and collaborating on applied research projects. They also plan to follow up on details and organize visits to further strengthen cooperation in fields such as renewable energy and biotechnology.

Al Mohandis then transitions to discussing the engineering works produced in student graduation projects. One project, supervised by Dr. Maamar Taleb, highlights the expectation that solar energy will account for 10% of global energy production by 2030, with a significant portion of this generation occurring in desert regions. The goal of this project is to improve the efficiency of solar panels by developing an intelligent cleaning system that removes dust while the system is operating,

controlled via a mobile application using Wi-Fi.

Another project, supervised by Dr. Raja Mohammed Sumsudeen, aims to develop a solution to extract energy from a 24V DC source in a household DC system, with automatic adjustment of output voltage for DC loads. It focuses on improving energy efficiency by eliminating AC conversion losses and using a smart wall plug (DC/DC). The current version provides a 50W adjustable channel from 1.5V to 20V. The buck-boost converter has been modified to enable gradual output voltage adjustment according to load current. Additionally, energy consumption during idle periods has not been adequately tested.

Another project, supervised by Dr. Fadhel Albasri, focuses on addressing power outages on farms while reducing operational costs compared to other solutions. This project involves collecting and analyzing data from farm owners to explore sustainable energy solutions and improve agricultural processes. It also examines alternative energy sources and applies optimal switching methods. The project adheres to the Saudi Building Code (SBC) and International Electrotechnical Commission (IEC) guidelines to ensure safe and effective implementation.

The project titled "Real-Time Fault Detection in Chemical Processes Using Simulink and Aspen Dynamics," supervised by Dr. Bassam Alhamad, aims to develop a fault detection system for a methanol plant using data analysis techniques such as Python, MATLAB, and Aspen HYSYS. The project includes data reduction using principal component analysis to effectively monitor plant processes. The system contributes to protecting workers and the community, reducing risks, and minimizing human and material losses.



## A Journey with an Engineer

### His Excellency Engineer Kamal bin Ahmed Mohammed President, Electricity and Water Authority (EWA) Between the Engineering Ingenuity and Art of Management



In this issue of Al-Mohandis magazine, we interview an engineering personality who charted his own path, choosing to study engineering in Bahrain over a scholarship. He graduated as an engineer... gaining experience in various roles and moving through positions, earning trust wherever he went. From municipalities to petrochemicals, he accumulated expertise over nine years. Between engineering, management, and ministerial roles, our guest's journey led him to the presidency of the Electricity and Water Authority in 2022.

In the following pages of Al-Mohandis magazine, we explore milestones from the career of our guest in this issue, His Excellency Engineer Kamal bin Ahmed Mohammed, President of the Electricity and Water Authority (EWA). Welcome.

**To start, the readers of Al-Mohandis magazine would like to know why Engineer Kamal bin Ahmed chose to study engineering, and which university and engineering specialization he pursued?**

Since my secondary school years, I had outlined my university studies, and my family played a significant role in supporting, guiding, and encouraging me to pursue this passion. I have always been fond of mathematics, and I found in engineering disciplines a field to apply these skills scientifically and practically. I received a scholarship to study in one of the Gulf countries. However, the University of Bahrain offered most engineering specializations. Therefore, I did not feel the need to travel or move to another country for studying, as the University of Bahrain

excels in this field. At the same time, the University of Bahrain is one of the prestigious universities that pioneered the establishment of various academic and scientific disciplines, earning a good reputation both regionally and internationally. However, when I decided to pursue a master's degree, I chose the University of Leeds in the United Kingdom, where I obtained a master's degree in international project management through a scholarship from the British Council at the time.

**The readers of Al-Mohandis magazine would also like to learn about your distinguished engineering career, your beginnings in the engineering sector, and your journey through various companies and official institutions until you earned the royal trust to be appointed Minister**



His Majesty King Hamad bin Isa Al Khalifa, King of the Kingdom of Bahrain, His Excellency President Abdel Fattah El-Sisi, President of the Arab Republic of Egypt, and His Royal Highness Prince Salman bin Hamad Al Khalifa, Crown Prince and Prime Minister, during the opening of the new passenger terminal at Bahrain International Airport on June 29, 2022. His Excellency Engineer Kamal bin Ahmed Mohammed, Chairman of the Electricity and Water Authority (then Minister of Transportation and Telecommunications) appears on the right of the picture.

### of Transportation and Telecommunications and later President of the Electricity and Water Authority (EWA).

After graduation, I worked briefly for less than six months at the Ministry of Municipalities Affairs and then joined the Gulf Petrochemical Industries Company (GPIC) for nine years. This was my first practical experience as a fresh graduate, and thankfully, it was a successful start. I learned a lot and benefited from the experienced engineers I worked with and under. It was my first test in professional and practical life. After that, I approach a new phase different from technical engineering work when I joined the Economic Development Board (EDB) in 2004 for approximately eight years, until I entered ministerial work after receiving the royal trust from His Majesty King Hamad bin Isa Al Khalifa, the King of Bahrain, may God protect and preserve him, in 2011 as Minister of Cabinet Affairs and later as Minister of Transportation and Telecommunications in 2012. Since 2022, I have held the position of President of the Electricity and Water Authority.

**Given the multiple positions you have held and the various institutions you have led in the Kingdom of Bahrain, were there specific strategies you kept in mind during each role or task assigned to you? Could you share some of these strategies with your Excellency?**

Each institution I had the honor of working with had its own specific plans and strategies. However, there are some constant ways to achieve the goals of any strategy. To define and follow any strategy in any field, it is essential to set clear objectives that we aim to achieve through that strategy. We work to set ambitious goals, develop plans to implement them, and monitor performance, as we always strive for the best options in terms of performance. No goal can be achieved without a strong team working together harmoniously and passionately to achieve common objectives.

Communication with other entities and fostering cooperation between institutions in the process of achievement and reaching what is required is crucial. Proper communication with everyone, defining roles, and listening to various opinions and ideas to achieve the best results are also essential. Flexibility in work, if it is within the framework of rules and regulations, saving time and resources to overcome obstacles without affecting the quality of work, and measuring work quality to improve performance and address any shortcomings are all part of the strategy. We also aim to benefit from existing resources and elevate them while adhering to the timelines for each project, reducing errors and risks, and improving productivity.





His Majesty King Hamad bin Isa Al Khalifa, King of the Kingdom of Bahrain, in a conversation with His Excellency Engineer Kamal bin Ahmed Mohammed (Vice Chairman of the Supreme Organizing Committee of the Bahrain International Airshow at the time), during His Majesty's tour of the exhibition in 2022.

All government entities in the Kingdom of Bahrain are committed to achieving Bahrain's Economic Vision 2030 and the government's action plan, with each entity working in harmony to complete its tasks in a balanced manner, establishing a work methodology and embedding principles of sustainability, competitiveness, and fairness to implement all programs according to the highest standards, working as one team through constructive cooperation between the executive and legislative authorities.

**What is the most important experience you have gained at each of these stages, Your Excellency?**

As I mentioned earlier, each institution I worked with had its own specificities and different circumstances. However, the Kingdom of Bahrain and its people have always been at the top of my priorities in terms of improving services

and facilities, achieving best practices for the future of upcoming generations, contributing to comprehensive economic development, and attracting investments. Additionally, work and giving are not tied to a specific time or period; it is a continuous process and a fast-moving wheel that needs to be kept up with.

**Was His Excellency Engineer Kamal bin Ahmed influenced by an engineering personality that contributed to shaping his academic path and choice to study engineering?**

I have learned from everyone I worked with at various stages, whether from my direct supervisors or colleagues. At the beginning of my career in the government sector, I always looked up to Mr. Yousif Al-Shirawi and Mr. Ibrahim Abdulkarim, the former Minister of Finance, as examples of statesmen who accomplished significant and important work in their professional careers.





His Royal Highness Prince Salman bin Hamad Al Khalifa, the Crown Prince and Prime Minister, and His Royal Highness the late Prince Khalifa bin Salman Al Khalifa, former Prime Minister, may God have mercy on him, with His Excellency Engineer Kamal bin Ahmed Mohammed, President of the Electricity and Water Authority “EWA” (Former Minister of Transportation and Communications), on the occasion of the Ministry winning two awards for Best Government Practices and Excellence in Customer Communication at the Government Forum, October 6, 2019.

Your name is associated with the aviation sector. What is your role in the Bahrain Aviation and Space Teams, and how do you evaluate this experience?

The primary reason may be attributed to the Kingdom of Bahrain entering a new phase during my tenure as the Minister of Transportation and Telecommunications, where the civil aviation sector was part of my responsibilities, and later, the Space Science Agency was added. Essential requirements emerged that necessitated collective efforts to achieve them, such as developing and improving the Kingdom's infrastructure, attracting new airlines, increasing economic and investment resources, as well as renovating and modernizing the airport. This was subsequently followed by the construction of a new terminal for Bahrain International Airport, which at the time required intensive efforts and diligent work to bring it to what it is today.

As for space sciences, it was an assignment I greatly

cherish, especially as Bahrain began to include this field in its strategy during that phase, based on the vision of His Majesty the King Hamad bin Isa Al Khalifa, may God protect and preserve him, which calls for enhancing Bahrain's status and elevating it to the ranks of advanced nations in space sciences, achieving comprehensive and sustainable development. The agency focused its efforts on establishing and training the Bahrain Space Team, qualifying around 20 young men and women, working on launching Bahrain's first satellite in history, in addition to harnessing space sciences and technologies for national development, encouraging space research and applications, and developing scientific programs in this field.

In the aviation sector, we believe that the construction of the new passenger terminal at Bahrain International Airport was a pivotal and significant milestone in the country's urban development journey, as well as in the journey of Engineer Kamal bin Ahmed as the then Minister



His Royal Highness Prince Salman bin Hamad Al Khalifa, the Crown Prince and Prime Minister, while reviewing the explanation from His Excellency the Engineer Kamal bin Ahmed Mohammed, President of the Electricity and Water Authority (EWA), during the inauguration of the Control Center for the Electricity and Water Authority (EWA) Networks in December 2024.

of Transportation and Telecommunications, who oversaw this major project until its inauguration.

#### **What were the challenges faced in executing this large project, both administratively and engineering-wise?**

Challenges are expected in any new project, but I prefer to focus on the achievement itself, which is this ambitious project that received significant follow-up and attention from His Majesty King Hamad bin Isa Al Khalifa, the esteemed King of the country, may God protect and preserve him, and from His Royal Highness Prince Salman bin Hamad Al Khalifa, the Crown Prince and Prime Minister, may God protect him. This success was achieved thanks to the combined efforts of various government entities and private sector companies, which contributed to reaching the level we see today.

The construction of the new airport represents one of the most vital projects in the Kingdom of Bahrain, as it directly contributes to supporting economic development and enhancing investment, in addition to being a civilizational landmark for the Kingdom and a major hub for travelers. It has successfully attracted major airlines, increased passenger capacity, and achieved numerous international awards. We all take pride in the fact that its management is carried out by Bahraini hands, and it was executed

according to the highest standards, within the specified budget and timeline.

#### **With your presidency of the Electricity and Water Authority (EWA), what strategies does the Authority adopt to ensure the efficient and effective execution of major projects?**

There is no doubt that the electricity and water sector is a fundamental pillar of urban, social, and economic development, as it is one of the vital resources that individuals and institutions alike depend on. In line with our commitment to providing reliable and high-quality services, we strive to ensure the sustainability of these resources in alignment with the national goals for sustainable development and Bahrain's vision to reduce carbon emissions by 30% by 2030 and achieve carbon neutrality by 2060.

In this context, our strategy focuses on improving the efficiency of electricity generation and water desalination plants, reducing losses, and increasing reliance on renewable energy. We are currently working to encourage investment in clean energy projects while enhancing the capacity to gradually reduce dependence on fossil fuels. The Electricity and Water Authority's plans also include developing infrastructure by expanding electricity and





His Royal Highness Prince Salman bin Hamad Al Khalifa, the Crown Prince and Prime Minister, during the inauguration of the Control Center for the Electricity and Water Authority (EWA) Networks in December 2024.

water transmission and distribution networks to meet growing demand, and modernizing systems by introducing smart technologies to improve network efficiency, such as smart meters and digital monitoring systems.

Digital transformation is a key focus of our strategy, as we work to employ artificial intelligence technologies to enhance maintenance efficiency and predict faults, alongside implementing Internet of Things (IoT) technologies in monitoring and demand management systems. The Authority also places special emphasis on environmental sustainability by reducing carbon emissions, fostering partnerships and investments, and building national competencies. In this regard, we are restructuring the electricity and water sectors by separating the regulatory and oversight bodies from those responsible for operations and network management, which contributes to enhancing operational efficiency and achieving the best global standards.

#### **How do you assess the role of the engineering sector in the developmental and urban renaissance of the Kingdom of Bahrain?**

The engineering sector plays a pivotal role in construction and, consequently, in the broader development process. It is the backbone supporting infrastructure and sustainable

development. It is an essential part of the entities striving to achieve sustainability through the application of green building technologies and the promotion of materials with low environmental impact. It also contributes to energy projects and improves the quality of life by designing cities and communities and providing comfort and safety for residents. Additionally, it oversees various facilities such as schools, hospitals, and centers. The sector is capable of providing diverse job opportunities for youth, not to mention urban expansion, revitalization of areas, technical and engineering innovations, and support for the Kingdom's economy by attracting investments and enhancing cultural and civilizational identity. In short, it is a fundamental sector contributing to developmental, social, and urban renaissance. It is not just a profession but a vital tool for achieving the aspirations of nations towards a better future.

#### **What are the most significant honors in your professional or community life?**

- Bahrain Medal in 2016
- Prince Salman bin Hamad Medal of Medical Merit in 2021

#### **What are the strategic efforts and plans of the Electricity and Water Authority (EWA) to achieve carbon neutrality**





His Royal Highness Prince Salman bin Hamad Al Khalifa, the Crown Prince and Prime Minister, His Excellency Shaikh Khalid bin Abdulla Al Khalifa, Deputy Prime Minister, His Excellency General Shaikh Rashid bin Abdulla Al Khalifa, Minister of Interior, and His Excellency Engineer Kamal bin Ahmed Mohammed (Minister Transportation and Communications at the time) during a tour of the new passenger terminal project at Bahrain International Airport, 24 March 2019.

**by 2060? And what steps and strategies have the Electricity and Water Authority implemented or is working on in the field of renewable energy, diversifying energy sources, ensuring their sustainability, and improving the efficiency of the energy sector, particularly solar and wind energy projects, and the opportunities for expanding these projects in the Kingdom?**

The Electricity and Water Authority (EWA) in the Kingdom of Bahrain is working within a strategic plan aimed at improving energy efficiency and rationalizing electricity consumption as part of national efforts to achieve carbon neutrality by 2060. To achieve this goal, the Authority is working on several initiatives, the most prominent of which is the National Plan for the Transition to Sustainable Energy, which aims to diversify energy sources and encourage investment in renewable energy. The plan also aims to increase the contribution of renewable energy sources to 20% of total energy by 2035.

As part of diversifying energy sources, the Authority will issue a tender to develop a solar power plant with a production capacity of up to 130 megawatts in the Bilaj

Al Jazayer area (Jazaer Beach) in partnership with the private sector. The Authority is also currently working on expanding the Al-Dur Renewable Energy Plant from the current capacity of 5 megawatts (2 MW from wind and 3 MW from solar) to 90 megawatts by mid-2026. It continues to seek to establish large-scale solar power plants and identify suitable lands and sites for these projects.

In addition to these projects, the Authority has launched the Net Metering Program, which aims to encourage the installation of solar panels on rooftops and other renewable energy systems. This program allows subscribers to generate electricity from renewable sources and transfer the surplus to the grid. Approximately 280 projects with a total capacity of about 72 megawatts have been completed. Projects with a total production capacity of about 320 megawatts are currently being implemented and planned.

At the end of last year (2023), the Authority launched the first phase of the national "Kafa'a" program (Energy Efficiency and Renewable Energy) to improve energy efficiency and reduce electricity consumption in the most energy-consuming buildings in the public and private



His Royal Highness Prince Salman bin Hamad Al Khalifa, the Crown Prince and Prime Minister, His Excellency Shaikh Khalid bin Abdullah Al Khalifa, Deputy Prime Minister, His Excellency General Shaikh Rashid bin Abdulla Al Khalifa, Minister of Interior, His Excellency Engineer Kamal bin Ahmed Mohammed (Minster of Transportation and Telecommunications at the time), and Tahleeq Group Team, during his visit to Bahrain International Airport to review the progress of the Airport Expansion Project, 24 March 2019.

sectors in the Kingdom in cooperation with energy service companies. A pilot project to improve energy efficiency in four government buildings has been completed, resulting in a 41% annual reduction in energy consumption, a 39% reduction in bills, and a reduction in carbon emissions by 5,430 tons in these buildings. Following the success of the pilot project, the Authority is working to target the most energy-consuming buildings in the public and private sectors to implement the program on a wider scale.

**Your Excellency, as President of the Electricity and Water Authority (EWA), and given the challenges facing the energy sector, we would like to know about the strategic projects and plans your esteemed Authority is working on in the field of electricity and water, particularly the challenges of energy transition?**

The Authority is working to diversify energy sources in alignment with the lofty royal vision of His Majesty King Hamad bin Isa Al Khalifa, the esteemed King of the country, may God protect and preserve him, and in fulfillment of the goals of the government of the Kingdom of Bahrain, led by His Royal Highness Prince Salman bin Hamad Al Khalifa, the Crown Prince and Prime Minister, may God protect him, under the National Plan for Sustainable Energy Transition.

In this context, the energy transition process and the implementation of the national plan face multiple challenges. The Authority seeks to expand the establishment of large-scale solar power plants while exploring solutions to

overcome the limited available space for renewable energy projects, whether through centralized projects or floating systems at sea. Efforts are also underway to identify suitable lands and sites for implementing distributed systems.

Additionally, the Authority is exploring innovative solutions in the field of modern energy technologies that align with the nature of the Kingdom of Bahrain. Currently, available options and their economic feasibility are being assessed. These efforts include studies to evaluate the feasibility of wind power plants at onshore and offshore locations, as well as exploring the potential for energy production using floating photovoltaic panels.

Your esteemed Authority has launched the "Kafa'a" program (Energy Efficiency and Renewable Energy) to improve energy efficiency in facilities in the public and private sectors. What are the main objectives of this program, and what is the percentage of improvement in reducing electricity consumption?

Regarding the efforts to implement the sustainable energy transition plan, the Authority has launched the "Kafaa" program, which aims to reduce electricity consumption in high-consumption buildings in both the public and private sectors in the Kingdom by utilizing energy service companies. Approximately 4 million Bahraini dinars have been allocated to improve energy efficiency in 20 government buildings as a first phase. The program aims





His Excellency Shaikh Khalid bin Abdulla Al Khalifa, Deputy Prime Minister, listens to an explanation from His Excellency Engineer Kamal bin Ahmed Mohammed, President of the Electricity and Water Authority (EWA), during a tour of Riffa offset station Interactive ability.

to enhance energy consumption efficiency in buildings by an average of 20%, with the goal of increasing energy efficiency in commercial, industrial, and government buildings.

Among the program's objectives is also contributing to the reduction of carbon emissions. It is expected to save approximately 308 gigawatts hours of electricity consumption and reduce carbon emissions by about 154,000 tons by 2040. Additionally, it aims to flatten the energy demand curve during peak hours and reduce the investment costs required to build additional power generation, transmission, and distribution plants. The program began by identifying high-consumption buildings, raising awareness about the program, issuing licenses to major energy efficiency companies, and launching tenders. Energy audits will be conducted for the targeted buildings, and the impact will be monitored, verified, and financial solutions will be provided to subscribers.

Furthermore, the Authority has completed a pilot project to improve energy efficiency in 4 government facilities, achieving a 41% annual reduction in energy consumption and a recorded decrease in carbon emissions of 5,430 tons annually.

**With the Gulf electricity interconnection with the Gulf Cooperation Council (GCC) countries, what is Bahrain's share of electricity supply in the interconnection network, and are there plans for expansion? What are the**

### **opportunities for the Kingdom of Bahrain in electricity trade or purchasing with GCC countries?**

The primary goal of the Gulf electricity interconnection is to provide immediate support to any member state in emergencies. The interconnection capacity with the Kingdom of Bahrain under normal conditions is 600 megawatts, and in emergencies, it is 1200 megawatts. Strengthening the interconnection is being studied to meet future needs.

As for electricity trade with GCC countries, the matter is being studied to find opportunities for selling, purchasing, or exchanging electricity, considering the stability of the Kingdom's electricity network and economic feasibility.

The electricity network has witnessed significant development and expansion, leading to increased reliability, security, and stability of the grid. What are the most prominent development projects that have contributed to this progress, which in turn has significantly reduced the rate of power outages?

The Electricity and Water Authority (EWA) has implemented a plan to develop infrastructure projects to meet the growing demand for electricity. Several projects have been completed to enhance operational efficiency, ensure the sustainability of services, and increase the reliability of the network. Among these projects are:

- East Hidd City Electrification Project:



A 220 kV main station and four 66 kV stations, along with associated transmission and distribution lines, have been commissioned to ensure sustainable services for subscribers.

- Electrification of Housing Projects in Askar and Sand:

Two 66 kV main stations and associated distribution lines have been completed to ensure reliable and efficient service delivery to subscribers.

- Hawar Island Project:

The 66 kV Hawar station and submarine transmission cables have been commissioned, ensuring integration with Bahrain's main electricity network and providing reliable and efficient services while enhancing grid flexibility.

- Reactive Power Compensation Stations Project:

Three reactive power compensation stations in Riffa, Manama, and Hadd have been commissioned to ensure the reliable and secure operation of the main electricity network and enhance Gulf interconnection.

- Electricity Distribution Network Automation Project:

The first phase of the distribution network automation project has been completed, aiming to improve network efficiency and service reliability by reducing outage durations and enabling faster fault response. Work is ongoing on the second phase, which covers over 1,000 distribution stations.

- Jasra 400 kV Project:

Work is underway on the Jasra 400 kV station and associated transmission network, a strategic project expected to be completed by late 2025. This project aims to enhance the utilization of the GCC Interconnection Authority (GCCIA) and improve the operational efficiency of the transmission network, particularly in the Riffa area, while meeting the growing electricity demand in Jasra and enhancing grid resilience.

- 66 kV Transmission Stations Projects:

Three 66 kV stations are under construction in Karzakan, North Riffa, and Bilaj Al-Jazayir to develop the transmission and distribution network and meet subscriber demands in these areas.

- Future Projects Related to Sitra 400 kV Station:

Plans are underway to begin work on the Sitra 400 kV station and associated transmission network starting in 2026, following the completion of consultancy work. A 400 kV main station and transmission network will be established to accommodate the electricity produced by the Sitra Power and Water Plant, expected to be operational by the end of 2026.

- Electricity and Water Networks Control Center Project:

This center primarily aims to control and monitor all electricity and water networks in the Kingdom. Its role begins with monitoring the production of electricity and water, then controlling electricity transmission networks, and finally managing distribution networks to ensure reliable and efficient delivery of services to subscribers. The center operates using advanced control systems and innovative technologies that align with the latest developments in the electricity and water sectors. It oversees the electricity transmission network, which includes 258 main transmission stations and an underground cable network with a total length of 1,906 kilometers. Additionally, it monitors and manages electricity distribution networks, comprising 10,400 substations. Furthermore, the center supervises and controls desalination plants and water transmission and distribution networks, which consist of 46 water transmission and distribution stations and a pipeline network with a total length of 618 kilometers. This enhances operational efficiency, ensures service sustainability, and improves performance and network reliability.

The Authority consistently strives to achieve its goals of providing sustainable services with the highest standards of efficiency and effectiveness. Our efforts to address the record-high electricity loads in the Kingdom reflect the scale of investments in the infrastructure of the electricity and water sectors, as well as the use of advanced technologies and highly skilled technical personnel. Despite the record-high electricity loads during the summer season, the Authority achieved a reduction in outage rates. Medium-voltage cable faults decreased by 11%, and low-voltage cable faults decreased by 13% compared to the previous year. During this period, the Kingdom of Bahrain recorded its highest peak load in history, reaching 3,819 megawatts in the summer of 2024, representing a 2.99% increase in consumption compared to the previous year.



His Excellency Engineer Kamal bin Ahmed Mohammed, President of the Electricity and Water Authority (EWA), during his reception at his office in the Authority for the Board of Directors of the Bahrain Society of Engineers on the 5<sup>th</sup> September 2024.

This positively impacted network reliability indicators, which are internationally recognized. The System Average Interruption Frequency Index (SAIFI), which measures the number of network interruptions per year, decreased to 0.11 compared to the international average of approximately 1. Similarly, the System Average Interruption Duration Index (SAIDI), which measures the duration of network interruptions in minutes per year, decreased to 4.43 minutes compared to the international average of about 116 minutes. This confirms the global excellence of Bahrain's electricity network and its ability to provide high-quality, reliable, and dependable services.

#### **What technological innovations and digital transformation services have been introduced by the Electricity and Water Authority to improve services for citizens?**

The Electricity and Water Authority has a strategic plan that includes digital transformation as one of its key objectives through several initiatives, such as the new Control Center and the completion of smart meter installations. These initiatives contribute to enhancing the services provided to subscribers by offering features such as accurate, automated, and remote meter readings without the need for human intervention. Additionally, smart meters protect subscribers and their electrical devices by automatically disconnecting the power supply in the event of additional loads. They can also record data related to the quality of

the electrical current for subscribers. Another advantage is the quick activation of subscriber accounts by remotely connecting the electricity supply to the meters without the need for on-site visits.

Smart meters have a positive impact, providing high accuracy in consumption calculations thanks to their advanced technologies. It is worth noting that all developed countries rely on these meters, not only for their high accuracy in consumption calculations but also because they provide precise data that helps improve network management more effectively and measure the quality of the electrical current for subscribers. This data also enables customers to monitor and manage their consumption more efficiently.

Moreover, smart meters feature remote reading capabilities, eliminating the need for manual reading. This helps avoid the costs of repeated visits for meter readings and reduces estimated readings. They also protect subscribers and their electrical devices by automatically disconnecting the power supply in case of additional loads. Another advantage of smart electricity meters is the quick activation of subscriber accounts by remotely connecting the power supply without the need for on-site visits. Subscribers can disconnect and reconnect the power supply within minutes by submitting requests through the government's electronic portal, with the process being fully automated and requiring no human

intervention, unlike the previous process that required visiting service centers, filling out forms, and sending inspectors to the sites.

The Smart Meter Operations Center aims to manage the operations of smart electricity and water meters that have been installed for all subscribers. This contributes to improving the subscriber experience by speeding up services and providing an integrated system that includes automated consumption readings without human intervention, reducing estimated readings, and helping detect tampering and verify the quality of electricity and water. The center relies on analyzing data received from smart meters to make decisions, enhancing the Authority's ability to provide innovative services that meet subscribers' expectations.

The new billing system is an integrated system that offers many advantages to subscribers, most notably providing a clearer and more accurate bill to ensure that information is delivered more precisely to subscribers. It also speeds up processes to facilitate the delivery of all services to subscribers with higher efficiency.

The design and development of an electronic application and portal aim to meet customer needs by enabling them to submit service requests, track their requests, and pay their bills. The platform will serve as a new customer service channel, where all Electricity and Water Authority services will be digitized and offered through it.

### **How does the Electricity and Water Authority enhance cooperation with the private sector in executing major projects?**

The communication between the Electricity and Water Authority and the private sector is ongoing in the execution of various projects. For any project to succeed, it is essential for government entities and private sector companies to work together and cooperate to ensure its completion to the highest standards. In terms of electricity and water production, the Electricity and Water Authority, in partnership with the private sector, produces electricity and water through power and water purchase agreements with independent plants, such as the Al Hidd Electricity and Water Production Plant, the Al Ezzel Power Plant, the Durrat Al Bahrain (1) Electricity and Water Production

Plant, and the Durrat Al Bahrain (2) Electricity and Water Production Plant. Currently, the Authority is planning the construction of the Sitra Independent Power and Water Plant with a production capacity of (1,200 megawatts and 30 million gallons of water) and the Al Hidd Independent Water Plant with a production capacity of (60 million gallons of water). The commercial operation of both plants is expected to commence by 2028 and 2029, respectively.

### **How would you describe Engineer Kamal bin Ahmed's relationship with the Bahrain Society of Engineers (BSE), and how do you evaluate its performance as a professional society working to develop the engineering profession and support the engineering sector in the Kingdom of Bahrain?**

The relationship with the Bahraini Society of Engineers has always been positive and fruitful, as the Society is one of the active entities dedicated to serving the Bahraini community and advancing the engineering field in a way that serves the national interest. It brings together an elite group of distinguished engineering expertise, and I extend my sincere thanks and appreciation to the Society for its prominent role in developing the profession and supporting the engineering sector in the Kingdom. I also always make it a point to respond to the Society's invitations and participate in its various events in recognition of its valuable efforts.

### **We would like to conclude this meeting with you, and we kindly ask for a word of advice or guidance for our young engineers from an esteemed engineer and senior official.**

I thank the Bahraini Society of Engineers for their interest, as well as Al-Mohandis magazine for this meeting. My advice to young engineers is to build a strong foundation from the beginning, rooted in technical and scientific knowledge. They should understand the fundamentals and requirements of their specialization, continuously learn from those around them, and stay updated on everything new in the engineering field. They should be passionate and actively seek innovation, as engineering is not just about technical applications but also a vast field for creativity and innovation. Above all, they should never fear failure, as it is an integral part of the learning process.

With best regards and wishes for success.



## Muharraq Ring Road and the Fourth Causeway Project

### General Objectives of the Project:

Muharraq Ring Road: The project aims to provide safe and fast access to the neighboring villages (Al-Hidd, Dair, Samaheej, Galali) as well as to the entrances and exits of investment housing projects such as Amwaj, Dilmunia, and Diyar Al-Muharraq. The road stretches between Busaiteen and Diyar Al-Muharraq, and the road was opened to traffic on December 31, 2024.

The project involves the construction of a road with four lanes in each direction over more than 8 kilometers, starting from the Dry Dock Road at the entrance of Diyar Al-Muharraq to the southern limit of the Al-Sayah area in Busaiteen,

connecting to Street 105 and from there to the Shaikh Isa bin Salman Causeway in the current phase. The project includes three intersections managed by traffic lights, at the intersection of Diyar Al-Muharraq with the entrance to Samaheej



and Dair, at the road connecting to Rayya Highway, and another intersection along Avenue 9 heading toward the Municipality of Muharraq and Avenue 105. Additionally, the project includes connecting roads branching to Samaheej, Dair, and Busaiteen, totaling about 3 kilometers, including two additional intersections managed by traffic lights. The project also includes the creation of a rainwater drainage network and three pump stations to discharge rainwater into the sea, in addition to the installation of a main sewage line and a treated water line. It includes protective measures for underground utilities that may be

affected by these changes, electrical cables for street lighting, and the installation of pedestrian barriers to ensure safety during crossing or use of the road.

This road plays a significant role in reducing congestion at current entry points between the Muharraq Governorate and the Capital Governorate, including the Shaikh Khalifa bin Salman Causeway and the Shaikh Hamad Causeway, as well as current traffic congestion on Rayya Highway. The new road now serves as an alternative for traffic movement from northern Muharraq to Manama through the Shaikh Isa bin Salman Causeway until the completion of phase IV of the project, which involves constructing the fourth sea causeway connecting the Al-Sayah area with Manama at the Bahrain Bay.

It is noteworthy that the project was awarded by the Tender Board to the consortium of Nass Contracting Company (Bahrain) and Nasser Hazaa Al-Sobaie & Brothers (Saudi Arabia) at a value of 37.2 million Bahraini Dinars, funded by the Saudi Fund for Development. An additional four million Bahraini Dinars was allocated by the Kingdom of Bahrain, represented by the Ministry of Finance and National Economy, for additional works, including the widening of Avenue 105 in the section between its intersection with Avenue 9 and the Shaikh Isa bin Salman Causeway, aimed at improving traffic flow between the street and the Shaikh Isa bin Salman Causeway. This section was opened on December 8, 2024. The additional works also included the establishment of a main sewage network to serve some surrounding areas.

### **Strategic Goal of the Project:**

**The Fourth Causeway:** The project forms a link between Diyar Al-Muharraq and the neighboring areas of Busaiteen and Al-Sayah, where the Busaiteen Causeway (the fourth Causeway between Manama and Muharraq) is located. This





Map showing the route of the Muharraq Ring Road and Busaiteen Causeway project

phase (Phase 4) will commence in 2025, once the necessary procedures are completed.

This project will contribute to smoother traffic flow between Muharraq and Manama, as it is one of the most important strategic projects in line with the government's program. It will provide high-quality infrastructure to support sustainable economic growth and meet the current and future needs of the Kingdom of Bahrain. The project is also expected to be a key contributor to economic development and will help attract investments, supporting the revitalization of various economic sectors in the Kingdom. The road connects the northern part of Muharraq Island with the capital via Bahrain Bay.

This phase involves the construction of two causeways. The first is a sea causeway connecting the Al-Sayah area with the Bahrain Bay, with a length of 482 meters and a width ranging from 56 to 64 meters. This Causeway will have five lanes in each direction, plus a separate lane for pedestrians

and cyclists in each direction. The main span of the sea causeway is 150 meters long and 11 meters above sea level. This cable-stayed bridge is expected to become a unique architectural landmark once completed within three years. The second causeway is a one-way causeway, 390 meters long and with three traffic lanes, designed to serve the traffic heading from Muharraq towards Al-Fateh Highway in the capital.

### Implementation Phases:

This strategic project consists of several phases as follows:

#### • Completed Phases:

- o Phase 1 and Phase 2: Earthworks for the Muharraq Ring Road corridor. Then, additional earthworks for the Muharraq Ring Road corridor.

#### • Ongoing Phases:

- o Phase 3: Muharraq Ring Road linking Diyar Muharraq, Al-Sayah, and Shaikh Isa bin Salman Causeway via Avenue 105 (currently under





An imaginary image of the Busaiteen Causeway, one of the strategic phases of the Muharraq Ring Road project.



A part of the Muharraq Ring Road





Special pedestrian path at Busaiteen Bridge



A part of the Muharraq Ring Road





Imaginary side view of Busaiteen Causeway

construction).

- o Phase 4: The sea causeway and the Bahrain Bay intersection bridge (currently in the bidding stage).

- o Phase 5: Support and connecting roads (Avenue 105). The section between Avenue 9 and Shaikh Isa bin Salman Causeway has been completed as part of Phase 3, with the remaining section to be completed in the future.

- o Phases 6, 7, and 8: Sea causeways providing additional connection points between the Muharraq Ring Road and vital neighboring areas such as Manama and Diyar Al-Muharraq.

### **Achievements:**

The main road for traffic was opened on December 31, 2024, with the remaining works to be completed throughout 2025, including the section connecting to Rayya Highway.

### **Role of Bahraini Engineers in the Project:**

Bahraini engineers play a prominent role in this strategic project, from the planning phase to the execution phase, through various government agencies, engineering companies, and contracting firms. Bahraini engineers are actively involved in overseeing and executing the work at the site through teams from the Ministry of Works, consultants, the main contractor, subcontractors, and engineers from the Electricity and Water Authority (EWA), Bahrain Airport Company (BAC), and other institutions associated with the project. The ministry also continues to collaborate with universities, providing practical training opportunities for students as part of the project to fulfill university requirements and gain practical experience during summer vacations. The project has welcomed over 30 civil engineering students for field visits to learn about the project and roadworks in general.



## Articles



Eng. A. Majeed Al Qassab  
Member of  
Bahrain Society of Engineers



# Strategic Project Management Through the Role of BSE's Project Management Association

In an era marked by economic challenges and industrial transformation, the role of project management has never been more critical. The demand for professionally qualified project managers is paramount as organizations seek to navigate complexity, deliver value, and achieve strategic objectives. The Bahrain Society of Engineers (BSE) has taken an initiative to form project management association chapter. Below, please find the core pillars of the Project Management Association (PMA) initiatives.

## The Vision and Role of Project Management

Projects form the cornerstone of today's work environment. Whether in business, government, or non-profit sectors, project management provides a structured approach to achieve objectives on time, within budget, deliver value, and to the satisfaction

of all stakeholders. Globally, organizations leverage professional project management to drive change and align their strategies with evolving market demands.

Project management stands out as a multidisciplinary profession that integrates technical expertise, leadership acumen, and a





HE the Minister of Works and HE the Minister of Municipalities and Agricultural Affairs, along with a constellation of attendees at the establishment ceremony of the Project Management Association at the Bahrain Society of Engineers (BSE) and the accompanying seminar entitled «Planning and Implementing Infrastructure Projects: The Development of Al Fateh Highway as a Model».

deep understanding of human dynamics. Despite its importance, the number of certified project management professionals in our region remains significantly lower compared to other parts of

the world. This gap often results in challenges in finding qualified talent to lead and manage projects effectively.



Notable attendance from members and interested individuals at the establishment ceremony of the Project Management Association at the Bahrain Society of Engineers (BSE) and the accompanying seminar titled «Planning and Implementing Infrastructure Projects: The Development of Al Fateh Street as a Model».





Presenting a commemorative plaque to His Excellency Engineer Ibrahim bin Hassan Al-Hawaj, the Minister of Works.

## Learning from Global Best Practices

Countries in the West have pioneered benchmarking initiatives to measure project management maturity across industries. Bahrain has a unique opportunity to adopt and adapt these practices to foster a robust project management culture in the region. At the Bahrain Society of Engineers (BSE), we are dedicated to advancing the project management profession through conferences, seminars, and industrial partnerships. Our aim is to equip practitioners with the knowledge and tools necessary to achieve globally recognized project management certifications. Furthermore, we would work hard to ensure that such practices are adopted and applied through different organizations.

## Facing Challenges with Resilience

Every project professional encounters hurdles—tight deadlines, demanding clients, and unforeseen issues. Yet, the hallmark of a great project manager lies in their ability to view these challenges as integral to the project lifecycle. Success is achieved through persistence, focus, and maintaining a positive outlook, ensuring that the mission is never lost.

## Redefining Project Management Education and Training

To meet the demands of increasingly complex projects, we must prioritize specialized qualifications and holistic training programs. This involves integrating project management

techniques with complementary disciplines such as human resource management, strategic planning, IT, financial management, and value engineering.

The BSE Project Management Association is committed to cultivating a new generation of confident, unbiased, and highly skilled professionals capable of managing these complexities. By doing so, we contribute not only to the development of individuals but also to the economic growth and industrial efficiency of our region.

## Membership Benefits and Opportunities

As a nonprofit chapter of the Bahrain Society of Engineers, the Project Management Association thrives on BSE's members participation. Membership offers a wealth of opportunities, including:

1. Networking with industry experts.
2. Access to technical presentations, courses, workshops, and seminars.
3. Subscription to the association's updates and newsletters.
4. Invitations to presentations and dinner meetings.
5. Assistance in preparing for project management certifications.
6. Site visits to major projects and manufacturers.

The BSE also collaborates with global project management institutions to deliver cutting-edge training and resources, ensuring members stay at the forefront of the profession.



Presenting a commemorative plaque to Engineer Hamad Badow, Director of Road Projects and Maintenance Department at the Ministry of Works.

## The Path Forward

The Project Management Association has ambitious plans for the future. With continued support from leading organizations and institutions worldwide, we aim to enhance the project management profession and establish Bahrain as a hub for excellence in this field.

We invite all engineers and professionals to join this dynamic association, contributing to the growth of project management and reaping the benefits of being part of a thriving professional community. Together, we can shape a future where project management serves as the foundation for sustainable development and success.



## Articles



**Eng. Yusuf Al Moamen**  
Managing Director,  
Watt Mr Electrical Services,  
Kingdom of Bahrain

# Magnetic Induction and Its Applications in Medicine: A Revolution in Diagnosis and Treatment

## Introduction:

The medical field has witnessed tremendous advancements over the decades, thanks to scientific and technological innovations. Among these innovations, magnetic induction stands out as a pivotal technology that has revolutionized medical diagnostic and treatment methods. Magnetic induction relies on generating an electromotive force in a conductor due to a change in the surrounding magnetic flux. This physical principle, discovered by Michael Faraday in the 19<sup>th</sup> century, has found widespread applications in the medical field. In this article, we will explore some of the key applications of magnetic induction in medicine and how they have contributed to improving healthcare.

## Magnetic Resonance Imaging (MRI)

Magnetic Resonance Imaging (MRI) is one of the most prominent applications of magnetic induction in medicine. MRI uses a powerful magnetic field and radio waves to create detailed images of the body's organs and tissues. This non-invasive technique allows doctors to view internal body tissues with high precision, aiding in the diagnosis of a wide range of conditions, including tumors, internal injuries, and neurological disorders. MRI is a vital tool in modern medical diagnostics due to its accuracy and the fact that it does not use ionizing radiation.

## Magnetic Therapy

Magnetic therapy is another application of magnetic induction in medicine, which involves the use of magnetic

fields to relieve pain and promote healing in tissues. Permanent magnets or pulsed magnetic fields are used to treat conditions such as arthritis and muscle pain. Although this method is still under research and study, it is considered a potential alternative to traditional pain treatments.

## Transcranial Magnetic Stimulation (TMS)

Transcranial Magnetic Stimulation (TMS) is a technique that uses magnetic fields to stimulate nerve cells in the brain. TMS is used to treat severe depression and other mental health disorders, particularly when conditions do not respond to traditional treatments like medication and psychotherapy. Magnetic pulses are directed at

Figure (1) Magnetic Resonance Imaging "MRI"



Figure (Γ) Transcranial magnetic stimulation “TMS”

specific areas of the brain to stimulate neural activity, helping to improve symptoms in patients.

### Cardiac and Nervous System Monitoring

Devices for monitoring the heart and nervous system, such as Electrocardiograms (ECG) and Electromyograms (EMG), rely on magnetic induction to record the body's electrical activity. These devices aid in the diagnosis and monitoring of conditions such as cardiac arrhythmias and neuromuscular diseases. By using magnetic stimulation, health problems can be identified more accurately, enhancing the quality of healthcare provided to patients.

### Vagus Nerve Stimulation

Vagus nerve stimulation is a technique that uses electrical pulses generated by a magnetic device to stimulate the vagus nerve. This technique is used to treat conditions such as epilepsy and chronic depression. The treatment involves sending moderate electrical pulses to the vagus nerve, helping to regulate electrical activity in the brain and improve symptoms in patients.

### Blood Clot Removal

In some new treatments, magnetic induction is used to guide drug-loaded magnetic particles to blood clot sites

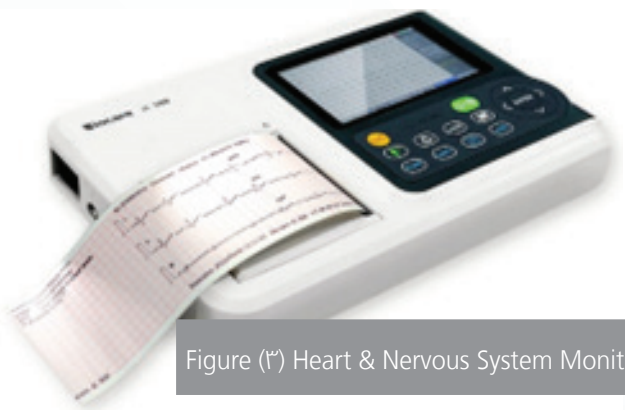


Figure (Γ\*) Heart & Nervous System Monitor

in the body. This helps to break down clots and improve blood flow in affected areas, reducing the risk of heart disease and strokes.

### Magnetic Surgery

Magnetic surgery is an emerging technique that uses magnetic fields to guide surgical instruments inside the body. This can reduce the need for large incisions and allows for less invasive surgical procedures. This technique is increasingly used in delicate and precise surgeries, reducing surgical risks and speeding up the healing process.

### Drug Delivery

Drug delivery is another area that benefits from magnetic induction. Magnetic nanoparticles can be used to deliver drugs directly to targeted areas within the body. This technique relies on magnetic induction to guide nanoparticles to specific regions, increasing the effectiveness of treatment and reducing side effects. This method opens new horizons in the treatment of intractable diseases such as cancer.

### Conclusion

Magnetic induction represents a revolution in modern medicine, offering innovative solutions for diagnosis and treatment. From MRI to nerve stimulation and magnetic therapy, the applications of magnetic induction stand out as powerful tools in improving the quality of healthcare and addressing a wide range of medical conditions. Research in this field continues to introduce new and innovative techniques, promising further advancements in the future of medicine and healthcare.



Figure (Ξ) Magnetic Induction to Remove Blood Clots



## Articles



**Dr. Walid El Fezzani,**  
Head of the Electrical and  
Electronics Engineering  
Department,  
Gulf University

# AI-Based Fuzzy Logic System for Precision Diabetes Risk Prediction

Dr. Walid EL FEZZANI, Head of the Electrical and Electronics Engineering Department at Gulf University, in collaboration with the University of Northampton in UK and the Sustainability and Development Makers Center at Gulf University, directed by Dr. Omar BLIBECH, has developed an AI-powered system to predict the risk of developing diabetes. This new system could transform

healthcare by helping people understand their risk of diabetes early and take steps to prevent it.

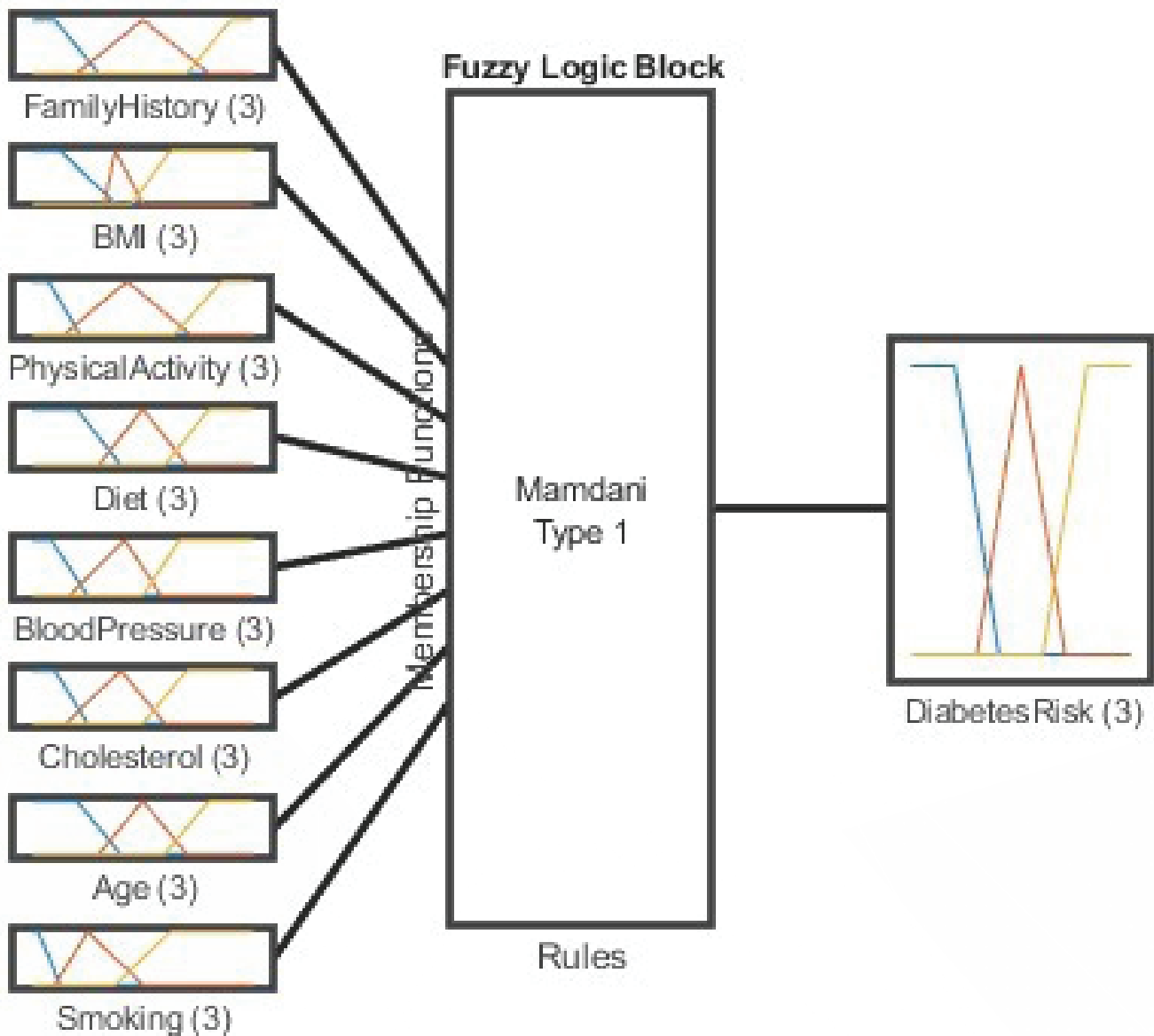
Diabetes is a growing global health problem that affects more than 500 million people worldwide. Early detection is crucial, but it's often challenging because the risk factors—like body weight, family history, and lifestyle habits—are complex

and can vary greatly from person to person. This new AI system tackles that challenge by analyzing a variety of personal health factors to provide a personalized diabetes risk score. It can tell someone whether they are at low, medium, or high risk of developing the disease, with an impressive accuracy rate of 87%. Using artificial intelligence (AI) and a system known as

fuzzy logic, the tool can understand and interpret information even when it's uncertain or not clear-cut, just like how our minds work when making decisions. It looks at eight key factors that influence diabetes risk: family history, body mass index (BMI), physical activity levels, diet quality, blood pressure, cholesterol levels, age, and smoking habits. Based on these factors, the AI system calculates how likely a person is to develop diabetes in the

future. For example, if someone has a family history of diabetes, a high BMI, and high cholesterol, the system can determine how these factors interact with one another to produce an overall risk score. It then provides easy-to-understand advice: if a person's risk is low (below 40%), they'll get tips on how to maintain a healthy lifestyle. If their risk is medium (between 40% and 70%), they'll be

encouraged to make changes, such as improving their diet or increasing physical activity. For those with a high risk (above 70%), the system advises seeking medical attention right away. What sets this system apart is its ability to learn and improve over time. It uses genetic algorithms to continually refine its predictions, making it more accurate the more data it processes. This means that it's



System for Diabetes Risk FIS: 8 inputs, 1 output, 1011 rules



not just a one-size-fits-all tool—each person gets a risk score and health advice tailored specifically to them.

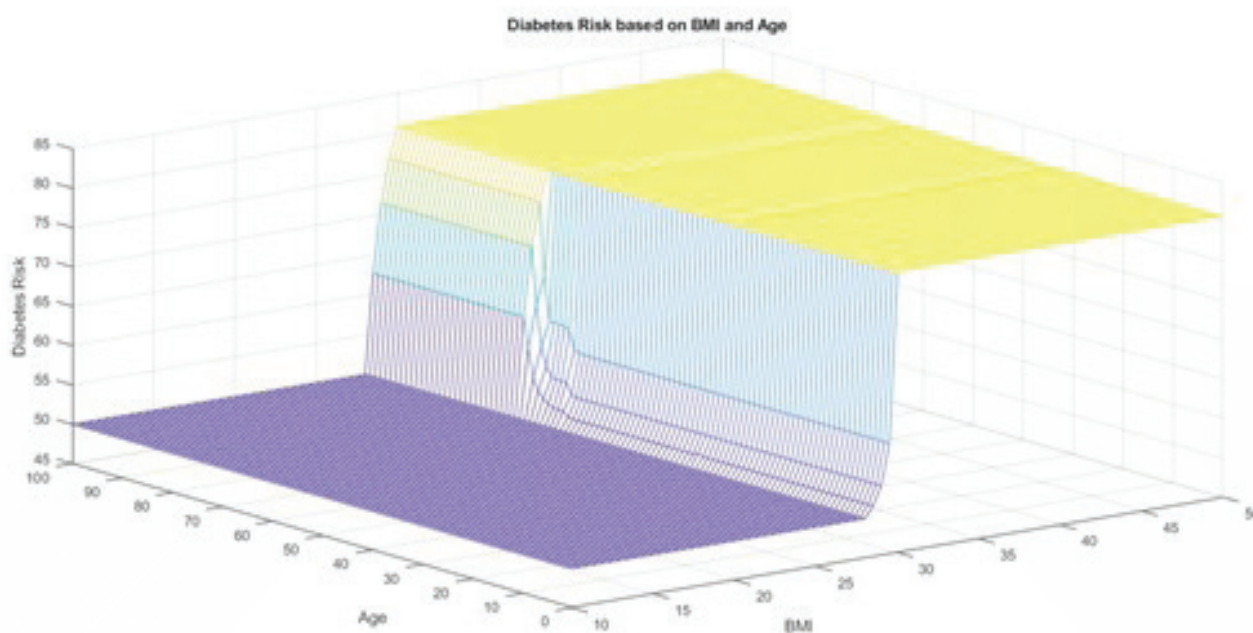
Dr. Walid EL FEZZANI, one of the key developers of the system, explains: “This is more than just a tool for doctors—it’s something that can help people understand their own health risks and take control before problems arise. It gives you a clear picture of where you stand and what you can do to stay healthy.” The system has been tested and confirmed by endocrinologists in both Tunisia and Bahrain, ensuring its reliability in real-world clinical settings. These specialists have validated the tool’s accuracy in predicting diabetes risk and offering practical health

advice. For more information about the system, you can visit <https://aidiabet.tiiny.site/> The importance of early detection cannot be overstated, especially in light of the growing number of diabetes cases worldwide. By catching the signs early and giving people the information they need to make changes, this system could help reduce the burden on health systems and improve lives across the globe. This innovative approach also aligns with the United Nations Sustainable Development Goal 3 (SDG 3), which focuses on ensuring healthy lives and promoting well-being for all.

By offering a tool that empowers individuals to manage their

health and prevent chronic diseases like diabetes, this AI system contributes to the global effort to achieve better health outcomes and reduce the prevalence of non-communicable diseases.

As this AI system becomes more widely available, it promises to revolutionize how we think about preventive healthcare. It’s a tool that brings the power of cutting-edge technology to the everyday person, helping them stay informed and proactive about their health. With real-world trials already proving its effectiveness, this tool could be a game-changer in the fight against diabetes, making a difference for millions of people



Diabetes Risk based on BMI and Age



**Eng. Ali Jaber Al Qattan**  
SCADA engineer  
(Aluminum Bahrain (ALBA))

## Portrait

A prominent figure in Bahrain's industrial automation sector, with over a decade of impactful contributions to leading organizations and groundbreaking projects. Recently appointed as a SCADA Engineer at Aluminium Bahrain (Alba), for his expertise in SCADA systems, automation technologies, and industrial modernization.

### Academic Background:

Master of Engineering in Renewable Energy, University of Bahrain (2023)

Master of Business Administration (MBA), Open University Malaysia (2022)

B.Sc. in Electronics Engineering, University of Bahrain (2012)

### Major Project:

Ali has contributed to numerous high-profile projects, including New Well Manifold and Tank Battery Oil Facilities (2013-2015) where Commissioned PCS systems with full instrumentation and FGS systems to improve safety and control mechanisms across multiple oil fields.

### Achievements and Recognition:

Ali was recognized as an Excellence Performer at Prudent Solutions and Kimberly-Clark for his exceptional contributions to automation engineering. He is also a published author, having co-authored the paper "Advanced Controller Design for D-FACTS Device in Grid-Connected Photovoltaic System Controller.

Ali is an active member of the Bahrain Society of Engineers (BSE), Ali shares his expertise and fosters collaboration within Bahrain's engineering community.





# TÜBİTAK MARMARA ARAŞTIRMA MERKEZİ



## A Model for International Professional Partnerships... Visit of the BSE Members to the Turkish TÜBİTAK Marmara Center

### Introduction:

During the trip organized by the Bahrain Society of Engineers to Turkey from December 1-5, 2024, a formal visit was arranged for the participating members to the TÜBİTAK Marmara Research Center in Istanbul, Turkey, on December 2, 2024. This visit was part of both parties' desire to strengthen their cooperation by signing future partnership agreements and emphasizing the importance of building bridges of communication between them. They also agreed on principles for cooperation in training, conferences, scientific research, and continued communication to

determine the details of the proposed agreements. Additional visits were planned to further enhance practical collaboration and implement joint initiatives in specific fields such as renewable energy and biotechnology.

This visit undoubtedly reflected the Bahrain Society of Engineers commitment to enhancing international partnerships and expanding cooperation with globally renowned institutions, supporting its vision of contributing to the development of the engineering sector in the Kingdom of Bahrain.



### **Impressions and Views on the Visit to the Turkish TÜBİTAK Center:**

Dr. Raida Al Alawi, President of the Bahrain Society of Engineers, spoke about the visit, emphasizing the importance of building international partnerships, enhancing scientific and technical cooperation, and exchanging experiences between the Bahrain Society of Engineers and globally recognized engineering institutions. This collaboration aims to broaden the horizons of cooperation, supporting the society's vision of contributing to the development of the engineering sector in Bahrain.

Engineer Habib Al Jaboori, Director of General Activities and Community Services Committee at the society, also spoke about the successful visit of the BSE members to the TÜBİTAK Marmara Center on December 2, 2024. The visit was marked by a warm welcome, informative presentations, and fruitful discussions about future cooperation opportunities between the two sides.

He expressed the Bahrain Society of Engineers gratitude to the management and officials at TÜBİTAK Marmara for their warm reception and hospitality during this visit, which included a session between both sides in the center's

conference hall. During the session, the officials at TÜBİTAK Marmara presented a comprehensive overview of the center's research mission, its key achievements, and the areas it focuses on, including clean energy, biotechnology, and natural resource management.

During the visit, both parties discussed opportunities for joint cooperation and initially agreed on key areas such as specialized training programs, organizing joint workshops and training programs to develop engineering skills, enhancing joint participation in regional and international engineering events, and collaborating on research projects with practical applications that meet the needs of both sides.

Both sides expressed their desire to formalize their cooperation by signing future partnership agreements and emphasized the importance of building bridges of communication between them. They also agreed on the principles of cooperation in training, conferences, scientific research, and continued communication to define the details of the proposed agreements. Additional visits would be organized to further strengthen practical collaboration and implement joint initiatives in areas such as renewable energy and biotechnology.



## Projects

### Students:

- Ahmed Mohammed Sadiq -
- Mahdi Sadeq Albasri
- Juma Abdulnabi Juma

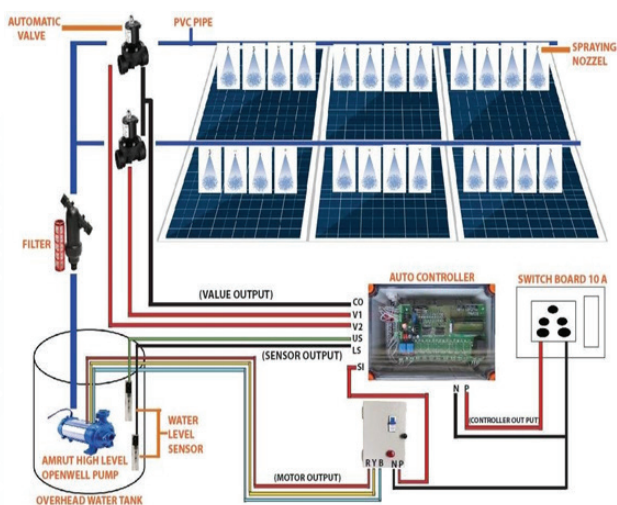
### Supervised by:

Dr. Maamar Taleb  
Associate professor,  
Electrical and Electronics  
Engineering Department,  
University of Bahrain

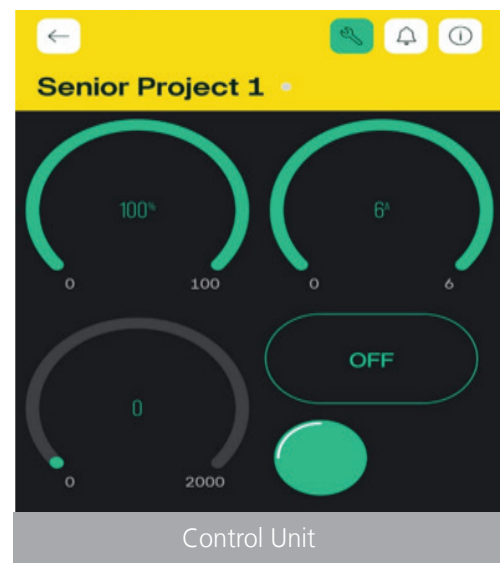
# Solar Panel Auto Cleaning System

This project study entitled “Solar Panel Auto Cleaning System” deals with solar power and is expected to account for 10% of global power output by 2030, with much of it generated in desert regions where sunlight is plentiful. However, dust accumulation on solar panels or mirrors is a significant issue that can reduce the performance of photovoltaic panels and necessitates regular cleaning.

The Middle East, characterized by dust storms and an arid climate, is particularly affected. Dust accumulation on the surface of PV modules can obstruct solar light from reaching the cells through the glass cover.



Solar photovoltaic cleaning system



Control Unit



Dusty photovoltaic panel on the right, very dusty photovoltaic panel on the left

The density, content, and particle dispersion of the dust can impact the power output, current voltage, and overall performance of PV modules. This project aims to enhance the efficiency of solar PV systems by using the current flowing through the PV panel, and the radiation to check for efficiency, and ensure that the PV panel is operating in efficiency of value 90%. The objective is to develop a smart cleaning system for solar PV systems that continuously removes accumulated dust while the system remains operational.

The proposed system is an autonomous smart cleaning system that moves across the surface of solar panels, controlled by a mobile app via a Wi-Fi network using the ESP8266 Lolin Nodemcu v3 integrated with various sensors. This method minimizes human involvement in cleaning solar panels, reducing exposure to hazardous conditions in the intense sun.



Clean photovoltaic panel



## Projects

### Students:

- Qassim A.Ameer Alwasti
- Ali Jameel Ahmed
- Ali Hasan Jaber Rashed

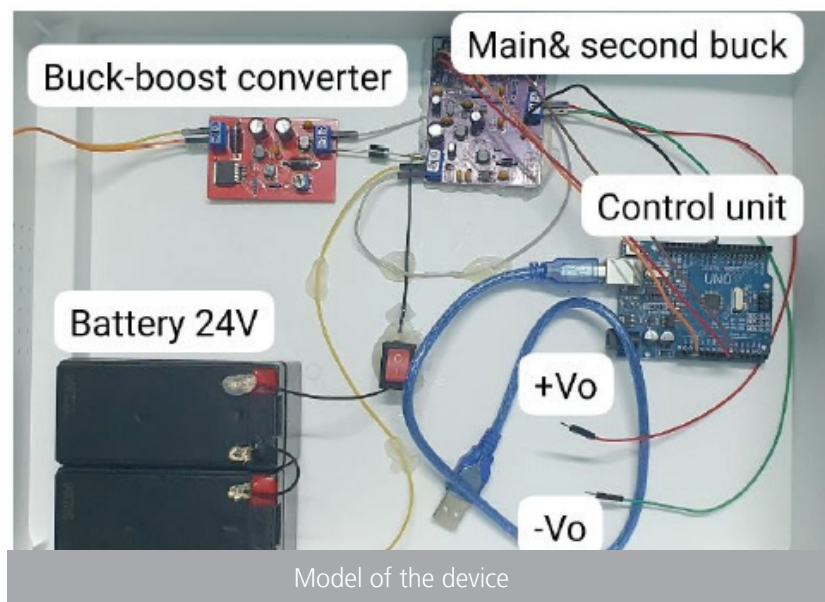
### Supervised by:

Dr. Raja Mohammed  
Sumsudeen,  
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Engineering Department,  
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# Design of smart DC/DC wall plug for the DC house

The main objective of this project entitled “Design of smart DC/DC wall plug for the DC house”, is to design a highly sophisticated converter capable of recognizing the precise voltage requirement of any device connected to its output. To achieve this, the converter needs intelligent features and capabilities. Solar energy has been chosen as the primary power source for its abundance and ease of use.



Solar panels are necessary to effectively utilize solar energy. However, their energy output is not consistent throughout the day due to variables such as temperature, solar radiation intensity, and



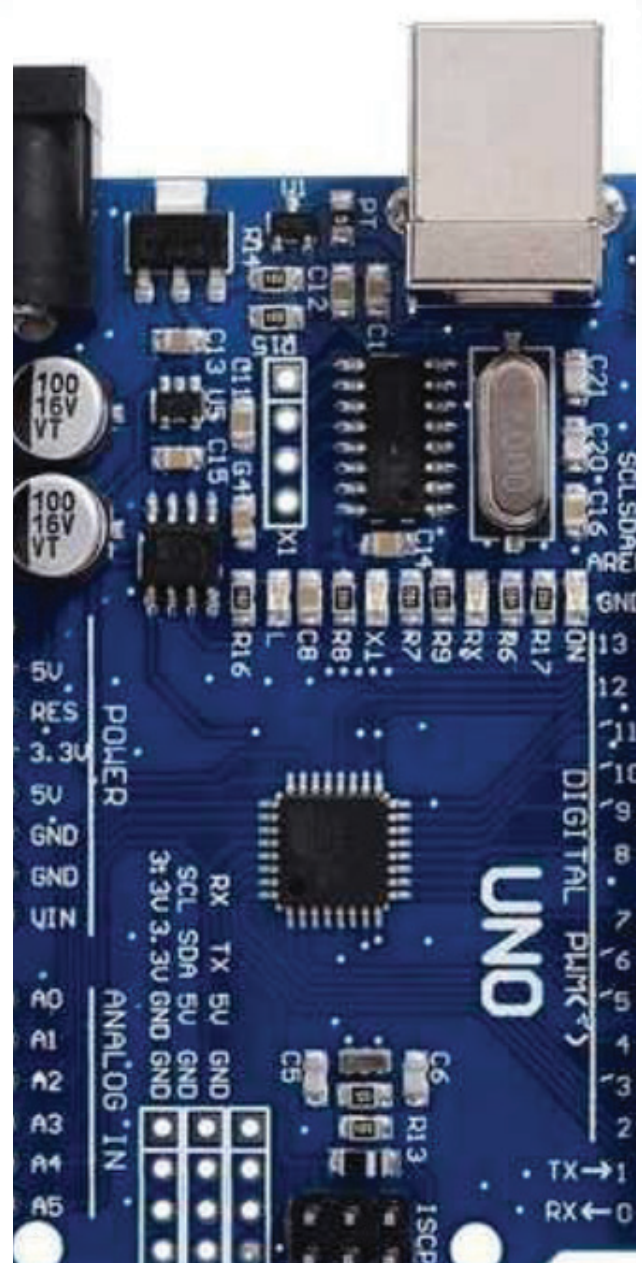
Back Post Conversion Board

shadows. Therefore, a fixed voltage input of 24 Volts has been determined as the optimal supply for the converter's operation based on thorough research.

An intermediary converter is required to bridge the gap between the smart converter and the solar panels. This converter acts as a crucial link, ensuring consistent and stable voltage supply for accurate identification and catering to the voltage requirements of connected devices.

A reliable controller, such as the Arduino platform, is essential for smooth control of the converter's operations. With appropriate programming, the controller effectively manages and regulates the converter's functions, ensuring optimal performance and adaptability.

While it's important to acknowledge the project's limitations, its potential for the future, especially in homes adopting clean energy solutions, is significant. The project envisions the development



Arduino Uno Board

of DC House, an innovative concept with promising implications for industrialization, economic prosperity, and sustainable living. As the project strives to pave the way for a greener and more eco-conscious future, it aims to serve as a catalyst for positive change, benefiting humanity in multifaceted ways.



## Projects

### Students:

- Yusuf Isa Al-Rashed
- Mohamed Abdurqeeb Abdulla

### Supervised by:

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Assistant professor,  
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# Design Standby Generator Panel to Supply Greenhouses Using Programmable Logic Controller



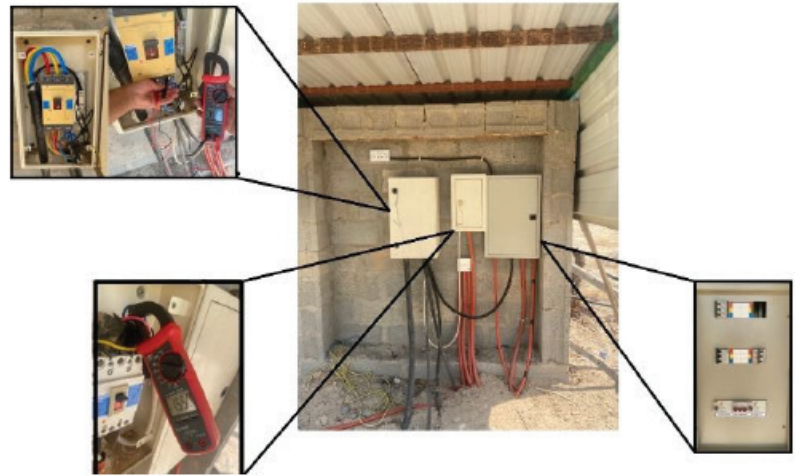
Al-Nuairiyah Governorate, Kingdom of Saudi Arabia



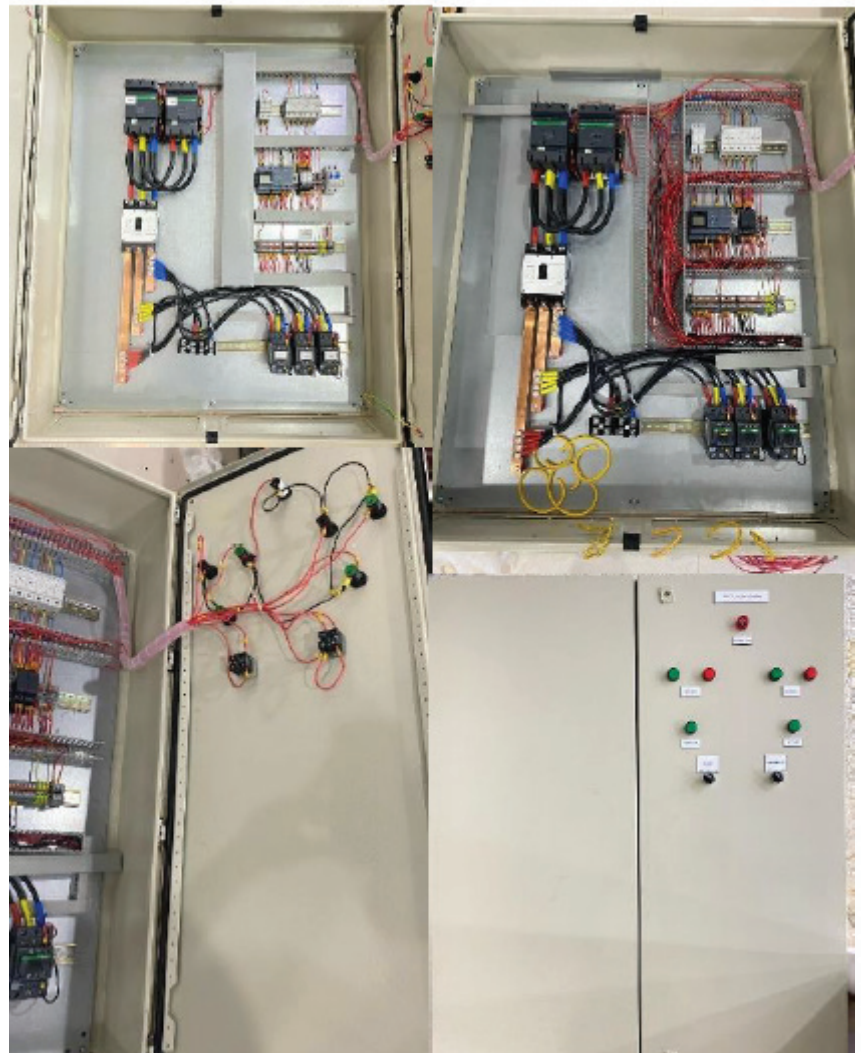
This project study entitled “Design Standby Generator Panel to Supply Greenhouses Using Programmable Logic Controller” investigates the proposed solution of a power outage caused in a farm with aim of achieving a lower operation cost as compared to other proposal solutions. Through farm owners, data was collected from them and studied well.

The report aims to provide practical solutions for uninterrupted power supply and improved efficiency in farm operations. Also, it focuses on exploring alternative power sources and implementing optimized switching methods. By adhering to the Saudi Building Code (SBC) standards and International Electrotechnical Commission (IEC) guidelines, the report ensures the safe and efficient implementation of electrical systems.

The project's objectives include resolving power outage challenges, enhancing reliability and sustainability, and contributing to the success of the agricultural sector in Saudi Arabia. Through research, analysis, and implementation, this report offers valuable insights and recommendations for overcoming power-related obstacles in farm environments.



Greenhouses (main electrical distribution board)



Automatic transfer switch control panel



## Projects

### Students:

- Amal Alqallaf
- Kamal Bukamal
- Rayan Albasri

### Supervised by:

Dr. Bassam Alhamad ,  
Assistant professor,  
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# Real-Time Chemical Process Fault Detection Using Simulink and Aspen Dynamics

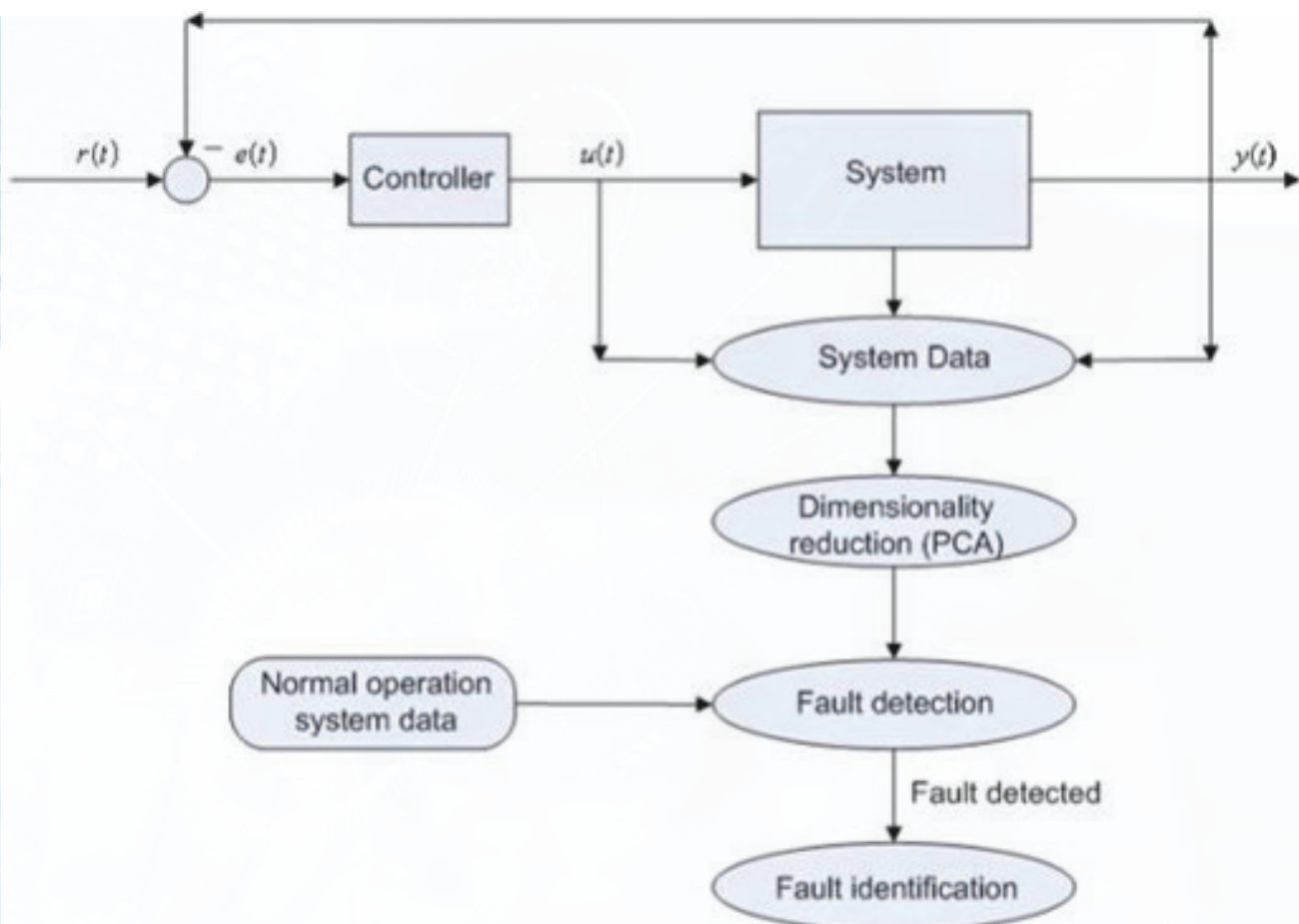


Figure 1 Strategy for Fault Detection

This project entitled “Real-Time Chemical Process Fault Detection Using Simulink and Aspen Dynamics” focuses on the development and implementation of a real-time fault detection system for a methanol plant, leveraging advanced tools such as Aspen HYSYS, MATLAB, and Python. The goal is to enhance the operational reliability and safety of the plant by detecting faults dynamically as they occur.

Starting with off-line, the system utilizes Principal Component Analysis (PCA) to reduce data dimensionality and identify key process variables, enabling efficient monitoring. Various faults including sensor biases, temperature drift, and valve malfunction are introduced to simulate real world conditions, and their detection is performed through real time integration between Aspen HYSYS and MATLAB.

The system’s effectiveness is demonstrated through its ability to detect faults promptly, minimizing downtime and ensuring continuous plant operation.

Then the system implemented for real-time the results show that the fault detection system significantly contributes to process optimization, offering a reliable solution for fault detection in methanol plants and similar industrial processes.

Future work will explore the integration of machine learning techniques to further enhance fault detection accuracy and system scalability.

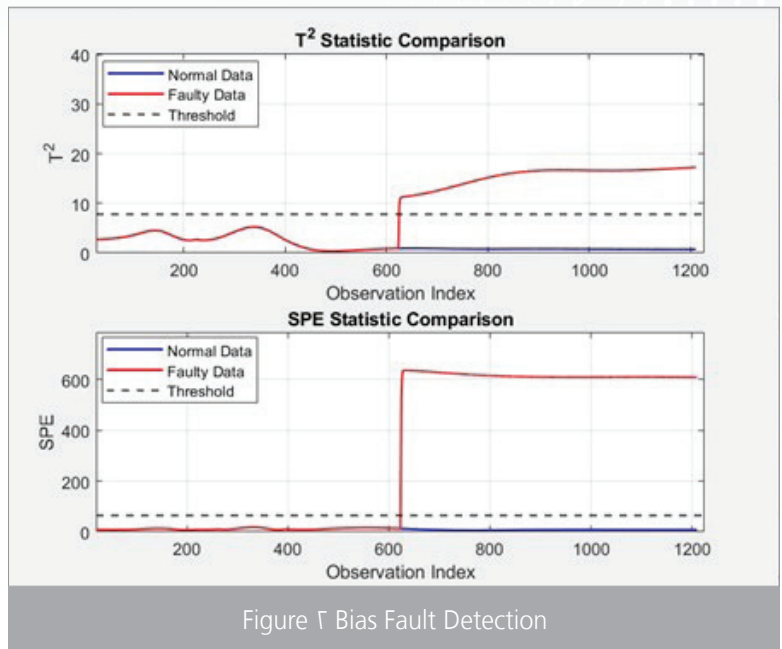


Figure 7 Bias Fault Detection

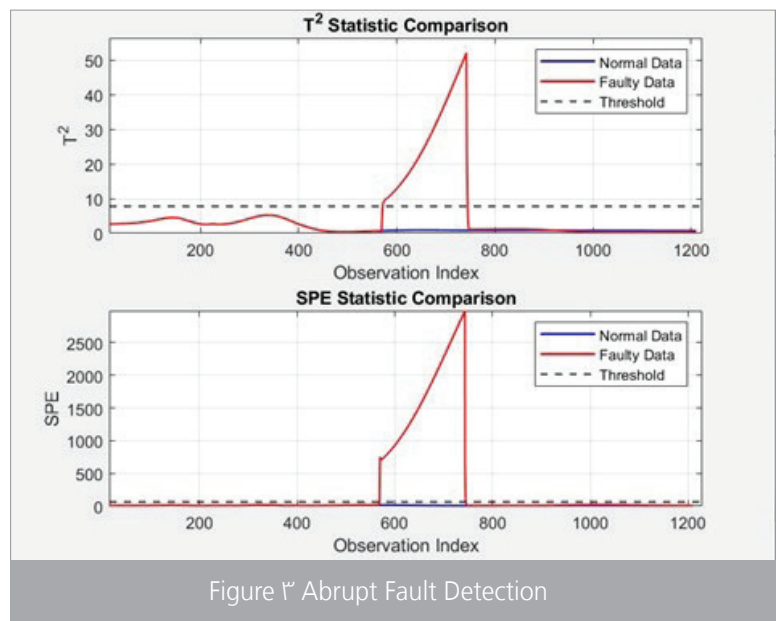


Figure 8 Abrupt Fault Detection

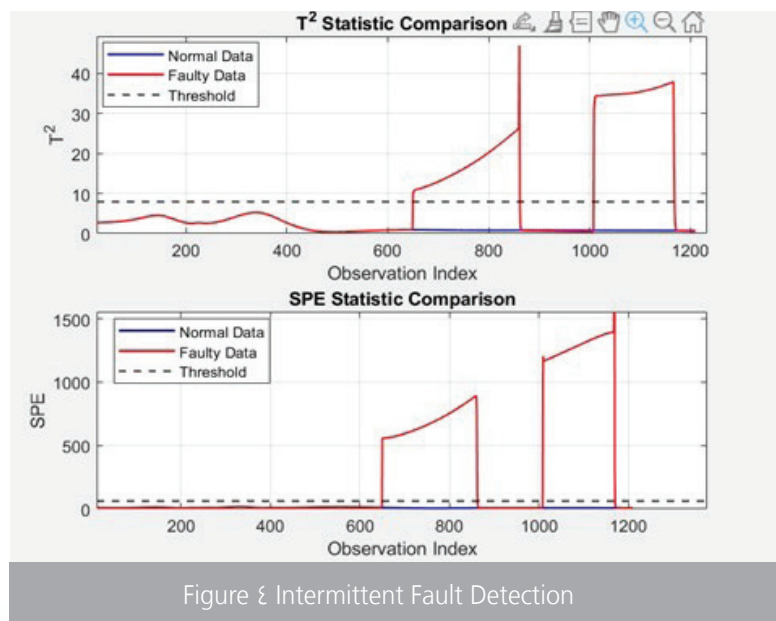


Figure 9 Intermittent Fault Detection



Upcoming

## Bahrain to Host the 8<sup>th</sup> Middle East Non-Destructive Testing (NDT) Conference and Exhibition 2025

The Bahrain Society of Engineers (BSE), in collaboration with the American Society for Nondestructive Testing - Saudi Arabian Section (ASNT-SAS), is proud to announce the 8th Middle East Non-Destructive Testing Conference and Exhibition, scheduled to take place at the Gulf International Convention Centre – Gulf Hotel, Bahrain, from December 1 to 4, 2025. Eng. Usama Badghaish, Department Director, Khursaniyah Gas Plant, Saudi Aramco will chair the Advisory Board of the conference.

This prestigious event has established itself as a premier platform for industry leaders, professionals, and experts in the field of non-destructive testing (NDT) with the theme “Quality Enhancement Through Digital Transformation.” “This conference is part of a successful series that

began 30 years ago, organized jointly by our two esteemed organizations,” said Conference Advisor Abdulmajeed Al Qassab. “Over the years, the conference has evolved significantly, keeping pace with the latest advancements in NDT technology and practices. It has become an ideal channel for exchanging knowledge, expertise, and innovations among engineers, professionals, and practitioners in the field.”

The forthcoming event promises to be the most comprehensive yet, with an ambitious technical program aimed at attracting the best speakers and professionals from across the globe.

The technical committee has targeted the presentation of 90 scientific papers that will be discussed and debated in three parallel sessions over the course of the three-day conference.



H.E. Dr. Abdul Hussain bin Ali Mirza, former Minister of Energy opened on 13<sup>th</sup> September 2015, the 7<sup>th</sup> Middle East Non-Destructive Testing (NDT) Conference and Exhibition 2015 in the Kingdom of Bahrain attended by a number of dignitaries and officials from the oil and gas industry, including researchers and engineers, from the global, Gulf and Bahraini companies.

In addition to the rich technical sessions, a technical exhibition will be hosted alongside the conference. This exhibition will feature participation from leading manufacturers, service providers, user companies, and consulting firms, both from within the region and internationally.

Participants will have the opportunity to showcase their products, solutions, and innovations while exchanging technical and technological expertise.

The exhibition will highlight the latest developments and solutions in NDT across key industries, including oil and gas, aviation, healthcare, power generation, and other major sectors. Special focus will be placed on identifying current challenges and offering practical solutions to address industry-specific issues related to NDT practices.

The event is expected to attract more than 1,000 engineers, professionals, and practitioners from various sectors. Additionally, over 100 vendors will display cutting-edge technologies, services, and innovations, providing a unique networking and business development platform for all participants.

For those in the NDT industry, this is a must-attend event that offers unparalleled opportunities for learning, networking, and collaboration. Attendees will gain insights into the latest technological trends and advancements while connecting with industry pioneers and decision-makers. Join us this December in Bahrain for an experience that will shape the future of Non-Destructive Testing!





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