



**Dr. Raida Al Alawi to
ALMOHANDIS:**
«Honored to be the
first woman elected
to the presidency of
the BSE»



Dr. Mohamed Al Aseeri:
«The Bahraini Satellite,
A major national project
reflects the interest of
the wise leadership»



Dr. Osamah Al Baharnah:
«BSE has always
looked after engineers
and supported their
interests»



ALMOHANDIS

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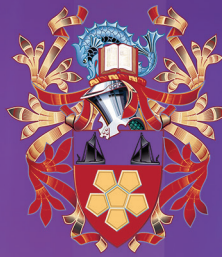
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The message of the Editor-in-Chief



**Eng. Ebrahim Ali
Al Burshaid**

Dear Engineers

We are pleased to place in your hands this 73rd issue of “Almohandis” Magazine which has been continuously published since issue number, thanks to the efforts of the engineers, both females, and males, of the Bahrain Society of Engineers that has celebrated its golden jubilee in 2022. The sustainability of this edifice confirmed its authenticity and deep-rooted history of engineering achievements that have lasted over the last 50 years, starting from the first brick that was laid down by the first generation of founders and will continue with the grace of Allah.

In this issue, we try to cover the major stages that the BSE has passed through. One of the major highlights in the history of BSE is that for the first time it is presided over by a woman since its establishment in 1972 when Dr. Raida Al Alwai won the position of president. On this occasion, we would like to express our sincere greetings to all female engineers who have exerted all efforts to become eligible to hold such senior positions with their dedication and qualifications, similar to those achieved by the Bahraini woman who has occupied senior leading positions in both public and private sectors.

We also would like to express our greetings to the Supreme Council of Women led by Her Royal Highness Princess Sabeeka bint Ibrahim Al Khalifa, Chairman of the Supreme Council of Women which has always been supporting Bahraini women and ensured equal opportunities in all professional spheres.

The achievements continue with the launch of the first fully-Bahraini Satellite Project in the Kingdom of Bahrain which was announced by His Highness Shaikh Nasser bin Hamad Al Khalifa, National Security Advisor, and Commander of Bahrain's Royal Guard, the details of which are covered in this issue. It is worth noting that the construction of the satellite will be undertaken by young and unique Bahraini talents who are

capable of converting challenges into national achievements and gains in line with the vision of HRM King Hamad bin Isa Al Khalifa, King of the Kingdom of Bahrain and the guidance of His Royal Highness Prince Salman bin Hamad Al Khalifa, Crown Prince and Prime Minister.

Finally, I would like to thank all those who have contributed to this issue and released it in the best form. I also value the voluntary efforts of Bahraini engineers who spared no efforts to provide “Almohandis” Magazine and other publications of the BSE with useful articles. We also welcome our colleagues of engineers to contribute to the coming issues with their experiences and knowledge and wish them all the best.

In a special speech to Al Mohandis, Dr. Raida Al Alawi:



«Honored to be the first woman elected to the presidency of the BSE»

Following the election and choosing her to preside over the BSE, "Almohandis Magazine" met with Dr. Raida Al Alawi to throw light on some characteristics of her personality as an engineer and the general aspects of her presidency during the following coming two years. Following is our interview with her:

At the outset, I believe that winning the position of president of such a major association as the Bahrain Society of Engineers is a challenging responsibility and I look at it as an honorable assignment.

I consider winning such a position is a major source of pride and honor for me. Such honor is stemmed from the confidence entrusted to me by the members of the BSE by electing me as the chairman of the board of directors for the term 2022-2024. I am also honored to be the first Bahraini woman elected to preside over the BSE. It is a new challenge and strong motivation for me to exert all my efforts and move forward toward a further positioning of the Bahrain Society of Engineers.

We are confident that the BSE has managed to emerge as a unique professional organization, and a pioneer in the field of voluntary and professional activities, locally and regionally for the last 50 years since its inception in 1972. It is today, as it was in the past, and also will be in the future, continuing to lay down an ambitious plan to develop the engineering profession and give the Bahraini engineer the opportunity to showcase his/her qualifications and experience in the development sphere.

The year 2022 is a remarkable year for the BSE since it celebrated its golden jubilee in mid-March and held major ceremonies under the auspicious of HRM King Hamad bin Isa Al Khalifa, King of the Kingdom of Bahrain.

We really hope that such golden jubilee celebrations will be a turning point in the 50 years history of the BSE. We highly value and appreciate the efforts of the founders, ex-presidents, directors, members of committees, and all members who spared no efforts to promote its name and the position it occupies today among its peers of professional organizations and the Arab and non-Arab engineering organizations. We will proceed from the past to a future that is full of achievements and successes, leading the BSE to further pioneering steps on both professional and voluntary levels, locally and regionally.

In this turning point to a new half-century, we look forward to furthering our achievements, and this is not possible without forming new work teams of members. On this occasion, I argue all the members to be prepared for enhancing the engineering profession, and this requires us to be creative to be able to achieve success. We as the board of directors undertake to attain the BSE's vision and contribute effectively to serving the engineering community in our beloved Kingdom.

Since I started thinking and deciding to nominate myself for the position of the BSE's president, I worked towards laying down a work plan and put forward general objectives to achieve, upon winning the position for the 2022-2024 term. In fact, we have lots of aspirations and plans that will help in enhancing our professional and voluntary work, thus driving the BSE to a further solid pioneering and unique position on both local and regional levels. Among these initiatives, is developing a comprehensive strategy for the BSE's activities for the next stage in line with its vision and message, taking into consideration the rapid changes in the engineering and technological world in addition to the major changes in the lifestyle which directly affect the efforts and the fulfillment of the requirements of voluntary work.

We also hope that such a new strategy would enhance the role of the BSE in attaining sustainable

development goals to keep pace with the world changes in this respect and reflect the vision of the BSE and its message in playing its pioneering role in developing the engineering profession in parallel with Bahrain's economic vision 2030.

This plan may require applying changes to the articles of association and the internal regulations related to administrative and financial affairs and also the scope of activities of various committees to ensure that they are in line with the requirements of the future stage and contribute to the attainment of growth and sustainability in the professional and voluntary work.

The engineering sector plays a pivotal role in the execution of the infrastructure and urban projects that contribute to the development process of the country. The Bahrain Society of Engineers is proud that it comprises an elite group of Bahraini members who have accumulated experiences and expertise over the years and become qualified in various engineering spheres. This has contributed vastly to the development progress that is witnessed by the Kingdom of Bahrain.

The BSE would like to underline the major role played by female engineers who have proven their abilities and qualifications in all engineering fields. The woman has managed to occupy various leading and senior engineering positions in various government and private enterprises. We would like in this context to praise the major support by the Supreme Council for Women in different fields, especially the engineering sector through numerous initiatives that contribute to the progress of women and applaud her efforts and efficiency to become a major contributor in the comprehensive development process and in the infrastructure projects. This comes as part of the vision to achieve equal partnership in building a sustainable competing society.



**Engineer Dr. Mohamed
Ebrahim Al-Asseeri,
CEO OF NSSA**

«The Bahraini Satellite is a major national project, and a foundation for strong development in the field of scientific research and technological development»

In line with the vision of His Royal Majesty King Hamad bin Isa Al Khalifa, King of the Kingdom of Bahrain, and the guidance of His Royal Highness Prince Salman bin Hamad Al Khalifa, Crown Prince and Prime Minister, His Highness Shaikh Nasser bin Hamad Al Khalifa, National Security Advisor and Commander of the Royal Guard announced the launch of first Bahrain's satellite building project. According to the project's schedule, it is expected that it will be completed and launched at the end of December 2023.

In this issue, we meet with Dr. Mohamed Ebrahim Al-Asseeri, the Chief Executive Officer of the National Space Science Agency (NSSA) to talk to us about this pioneering project:

• **What are the details of this new project?**

At the outset, I would like to thank you for offering me the opportunity to throw light on this project, which is the first of its kind on the island. It comes as an interpretation of the attention given by the wise leadership to the National Space Science Agency and its continuous observations of the ongoing initiatives that invest in the talents of young Bahraini youths from various engineering and technical disciplines, to

compete in the worldwide pioneering of the future sciences spheres, mainly space sciences and the related knowledge and skills.

The project is divided into two main parts: The first section is concerned with building a nano-satellite, with two main and subsidiary payloads. The main payload is dedicated to Earth observation through the use of cameras that are designed for imaging from space, and the sub-payload will include three unique Bahraini innovations that serve the space sector and use artificial intelligence and cybersecurity techniques in their implementation. This will be tested in the space environment when the satellite is launched into orbit in December 2023.

As for the second part of the project, it is concerned with building a space ground station that will allow the Agency to operate and manage the Bahraini satellite, as well as provide a source for satellite images and data that can be obtained through various satellites that pass through the Kingdom's space. Communication with them will be available in prior coordination with those who own them. This is an addition to the quality infrastructure for the space sector at the national level.

• **The satellite is supposed to be launched in 2023, so how are your preparations and arrangements for implementing this project?**

This question has a very long answer, but in short, it is known that any project requires a lot of preparation, as there are administrative, human, financial, technical, logistical, and other arrangements that are required.

The Agency's preparations for the implementation of this project began with the selection of the members of the Bahrain Space Team at the end of 2018, and sponsoring them to study and take part in the completion of the Light 1 satellite, and then their return to the country to continue their training and implementation of a number of research and studies. The preparation process also included conducting a study to determine the national requirements, then preparing technical specifications and conducting survey research to locate the latest technologies available globally. Following the foregoing steps, a set of laboratory equipment and basic electronic components were provided to work on this project, forming work teams, distributing tasks, and ensuring that all the expertise and knowledge required to design and build the satellite on the land of the Kingdom are available, including the contingency plans and risk management. The preparations also included the design and construction of an electronic system for the Agency to digitalize the entire project management. All these initiatives are purely Bahraini achievements and a source of pride for all of us. Coordination was also made with a specialized organization to conduct the final pilot tests of the satellite before launching it into space.

• **This is considered the first fully Bahraini satellite, what does that mean to you?**

Such a project is seen worldwide as one of the major national projects, especially as it lays a brick in building a new sector, and establishes a more powerful start in the fields of scientific research and technical development, which is the basis for the growth and progress of countries.

Undoubtedly, building the entire satellite in the Kingdom of Bahrain and by Bahraini engineers and technicians is a source of pride for every Bahraini citizen.

Countries spend huge sums of money to implement major national projects through which they seek to

occupy a prominent position in the world and to be a source of inspiration and pride for their citizens while seeking to encourage the youth to exert non-stop efforts for the sake of the glory of the nation.

• **In NSSA, you have already undertaken a number of missions that employ space technologies to serve the Earth, so what is the mission that the satellite will perform this time?**

The mission of the satellite is to focus on providing medium-resolution images of the Kingdom of Bahrain and its regional waters at a high rate, which will be used by the Agency's laboratories to analyze data and satellite images to meet the needs of a number of government agencies and to undertake scientific studies and conduct research in many fields such as agriculture, environment, energy, and urban planning, transportation, climate change, etc.

In this project, a Bahraini system will be built to operate the satellite and develop several software for sub-systems based on artificial intelligence that could be used and developed to build future satellites and register them as patents in the name of the Kingdom. This would gain the attention of the space community.

Furthermore, the satellite will also contribute to testing the previously mentioned innovations implemented by the Bahrain Space Team and ensuring their effectiveness and ability to achieve the goals for which they were designed in the space environment. We are optimistic about the success of these innovations, which will be considered advanced scientific achievements in the fields that are classified within the sciences of the future. This is in addition to forming a specialized national scientific base that may contribute effectively to scientific research, dissemination of knowledge, and encouragement of innovation. This undoubtedly will place the Kingdom of Bahrain among the leading advanced countries in technology, especially in the fields of space sciences.

• **Any final comments?**

We are still at the beginning, but with the faith and support of the wise leadership, and with the help of loyal Bahraini engineers and technicians, and their determination and dedication, we will be able to minimize the distances, catch up, and attain the expected achievements so that the Kingdom of Bahrain will always remain at the forefront



Dr. Osama Al-Baharnah:

«The Bahrain Society of Engineers has always looked after engineers and safeguarded their interests»

Interviewed and prepared for publication by
Husain Ismail

He was born and grew up in "Al Makharka' area, in Manama. Being an outstanding student during his high school years, he deserved a scholarship from the government to study engineering in Canada. His home computer attracted him to study computer engineering, and thus he was the first computer engineer in Bahrain and the GCC countries. He played football and squash at the university, and following his master's degree, he worked with "Matrox Engineering" in Montreal for approximately 10 years, and then with the University of Bahrain, which sponsored him to continue his Ph.D. studies.

This foregoing was a summary of our journey with our character for this issue of "Almohandis Magazine", Dr. Osama Al-Baharnah, and we start our journey with him as follows:

*** Tell us about the early days and the educational journey of Dr. Osama Al-Baharnah?**

I was born and grew up in "Al Makharka' area, in Manama in 1962, where my father's house was located on "Aqaba Bin Nafi Avenue", behind Abu Bakr Al-Siddiq School, close to Sacred Heart Church. In 1975, we moved out of Manama like many families in that period. At the age of four, I was enrolled in Sacred Heart School because of its proximity to my house and later went to American Mission School located in Hooraa area. I started kindergarten class and completed primary and intermediate school there. Later, I moved to Manama Secondary School, which was located in front of the Ministry of Education building in Qudaibiya area on Maaref Avenue, and the principal of the school at the time was Mr. Abdul Aziz Al-Sammak. The school moved to a new building in Adliya during my second year of study.

It is worth mentioning that I completed the fourth, fifth and sixth grades of primary school at "Amun School" in Zamalek area of Cairo where my father was serving as the ambassador for the State of Bahrain at that time.

Due to the proximity of my house to Manama Souk, I often used as a child to go to my father's shop in Bab Al Bahrain, located on Tijjar Avenue and spent a lot of time wandering around the market. During the summer holidays and public holidays, I used to work in the store, selling electrical and electronic appliances, installing electric fans to display in the store, photocopying documents for customers, and other works that I enjoyed and gave me a sense of responsibility and value. I graduated from high school in 1979 and won the third position in Bahrain in the scientific section of secondary school.

The cosmopolitan environment of Manama as well as my studies in private and government schools and spending a period of my childhood outside Bahrain has had a great impact on my culture and aspirations.

***What prompted you to study engineering?**

The seventies was a period of transformation with regard to the use of technology and the transition from electromechanical devices to the use of electronic chips in household and personal appliances. During that time the use of recording (video) devices, electronic game consoles, primitive computers, and reading periodicals concerned with electronic devices such as popular electronics was widespread. I was fascinated by Sinclair ZX80's first home computer, which went on sale in the early 1980s as user-reassembled parts (Kit). Therefore, I decided to study computer engineering and it was considered a new specialization at the time. Perhaps I was the first specialized engineer who graduated from computer engineering in Bahrain and possibly in the Arabian Gulf region.

*** Where did you study engineering and what was your first career in the engineering sector?**

I was an outstanding student during my second education, as a result of which I deserved a government scholarship to study engineering in Canada. So I enrolled to McGill University in Montreal in September 1979, and the city of Montreal at that time had a large number of Bahraini students. I recall that the summer of Montreal on 28th August 1979 was no better than the summer of Bahrain in that period either in terms of temperature or humidity.

When I was studying bachelor's degree in computer engineering, my relationship with a number of professors was strengthened. I used to play football and squash with them and help them in their laboratories and research, as I used to love academic life and scientific research. I decided to continue studying and graduated with a master's degree in computer engineering from McGill University. My graduation thesis was entitled "A Bit-Serial Floating-Point Multiplier-Accumulator for Massive Parallel Computing Structures". I managed to publish seven different papers in scientific journals and conferences during the period 1985-1988, and I am still in touch with some of the professors whom I met while studying at McGill University. Among my colleagues in

« I was fascinated by Sinclair ZX80's first home computer, which went on sale in the early 1980s, Therefore, I decided to study computer engineering »

Montreal during my bachelor's degree I may mention, for example, Dr. Sheikh Nizam Yacoubi, Dr. Sheikh Ali Al-Oraibi, Dr. Eng. Manaf Hamza, Engineer Mohamed Jawad Ibrahim, Engineer Mariam Jumaan, Engineer Haifa Al-Jishi, Engineer Lamis Al-Baharnah, Engineer Abdul Hussein Issa Ibrahim, Engineer Tarif Al-Tajer, lyad Al-Arayedh, Engineer Yasser Al-Baharnah, Engineer Sayed Aqeel Shubbar and Engineer Dr. Nader Al-Bastaki.

My first job in the engineering field was as an intern at the Juffair Power Plant during the summer months of 1981. Later I worked during the summer holiday and university studies as an assistant in engineering laboratories, and as a research and teaching assistant.

During my master's degree, I got to know Matrox Engineering, headquartered in Montreal, Canada, which has been and continues to be, a leading manufacturer of electronics and computer chip regulations for computer imaging and graphics. This company offered me to work for it in the R&D section after graduation and I agreed.

*** Can you briefly introduce us to your Ph.D. studies, where was it? And in which engineering discipline?**

On Wednesday, 1st August 1990, I submitted my resignation to Matrox with the aim of returning to Bahrain. On 3rd August, the company's director of research and development asked me to withdraw my resignation due to Iraq's invasion of Kuwait on 2nd August. However, I had already determined to return, driven by nostalgia for my parents and longing for home after an absence of eleven years. I returned at the end of that month and began working as a teacher in the Department of Electrical Engineering at the University of Bahrain in September 1990, since the university did not have a computer engineering department at the time. A year later, I was sponsored by the university to study for a Ph.D. in Computer



During a brainstorming session that included the pioneers and engineering elites of the former and current presidents and members of the board of directors - November 2010

Engineering at Imperial College in London, UK. The title of my doctoral thesis was “Area-Time Efficiency of FPGA-Based Computation”. I also have three papers published in various scientific conferences related to my doctoral thesis during the period 1992-1996.

*** We are eager to know some aspects of your journey in the engineering field in the country, from your beginnings to the moment, what are the positions that you have occupied during that professional period?**

After completing my Ph.D. I returned to my job at the University of Bahrain and continued to teach computer engineering subjects until I retired at the beginning of 2014. I served on several committees at the university and was appointed in 2008 as Head of the Department of Electrical and Electronic Engineering until mid-2011. I consider that one of the most important subjects I studied at the university was "Ethics of the Engineering Profession".

The academic life in Bahrain was not similar to what I experienced while studying in Canada and the United Kingdom, so I decided to enter the commercial arena. I began to work as a partner with my father in 1997 and established a computer services department. So I worked in this field, where I used to supervise many computer systems and application development projects in government institutions and private companies. I expanded the company's business related to air conditioning engineering projects, office equipment projects, and automation and opened a branch in Qatar in 2003 and in the UAE in 2008.

In 2003, I was elected as a member to the board of directors of Ahlia Insurance Company which granted me access to the world of finance and investment. I served on various board committees, later becoming the chairman of the audit committee as well as chairman of the executive committee, and vice chairman of the board of directors from 2011 to 2016, and then was elected chairman of the board of directors in 2016. At the end of 2017, the board of directors approved the merger of the company with Solidarity Bahrain. I continued in the insurance field as a board member and chairman of the audit committee with the United Insurance Company and then was elected to the board of directors of Bahrain Takaful Company at the beginning of 2018. I remained a member of the board of directors and chairman of the risk committee until today.

*** Talking about your career path in the engineering field leads us to learn about your relationship with the Bahrain Society of Engineers, where Dr. Osama Al-Baharnah is considered one of the prominent members. How did you come to know the BSE and then become a member? Tell us about your important achievements including membership of committees or boards of directors that have prepared you to reach to this position in the Bahrain Society of Engineers.**

I came to know the Bahrain Society of Engineers through my fellow engineering professors at the University of Bahrain upon my return from Canada. I applied for membership before I travel for my Ph.D. degree, and my application was accepted on 9th September 1991.

After returning from UK, I worked on the committees of the Society, including the Committee of the "Almohndis Magazine", and participated in a number of conferences and seminars organized by the BSE. In February 2008 I took part in organizing the 2nd Engineering Expo Exhibition. The BSE also asked me to organize a seminar on "The Effects and Consequences of the Global Financial Crisis on the Local Economy" in March 2008 and another seminar entitled "Investing in Higher Engineering Education" in June of the same year. These seminars were attended by a group of pioneers in the fields of engineering with academic and economic backgrounds.

In February 2010 I was elected to the Board of Directors of the Society of Engineers and then began managing the editorial of "Almohandis Magazine" and became the Secretary to the Board of Directors in April 2011. I did not run for the Board in the 2012 term and preferred to work through the committees. In addition to continuing to be a member of the Society's Membership Committee from 2010 until now, I have been appointed by successive presidents since that time to many special committees, including the chairmanship of the Committee of the Information Solutions Development Initiative of the BSE in November 2014, the membership of the Project Committee for the Development of the Second Phase of the Main Building of the BSE in 2015, the membership of the Committee of the BSE Award from 2018 to date, and the Preparatory Committee for the Arab ICT Forum 2020. The General Assembly also appointed me in April 2019 to chair the Committee for Drafting and Approval of the Financial Manual of the BSE. The Board of Directors nominated me in 2019 to be the Society's representative of the Union of Arab Engineers' Engineering Education Committee. In addition, I was among those who were honored at the BSE's Golden Jubilee celebrations in 2022.

*** Did the BSE's membership add anything to Dr. Osama Al-Baharnah?**

My volunteer work at the BSE prompted me to get to know fellow engineers working outside the academic field. It allowed me to work closely with a group of members who have dedicated much of their time and efforts over the past decades to serve BSE and the engineering profession in Bahrain. There is no doubt that I have learned a lot from them, and I owe them thanks and appreciation.

Through my various participations in the committees and events of the Society, I have realized the importance of volunteer work in the progress of Bahraini society and to continue building civic institutions. I have realized the importance of joint volunteer work in understanding others and bringing the views of the different components of society together.

My involvement in the academic and commercial field, financial institutions, and civil society organizations together has contributed to the development of my understanding, and awareness of the importance of work ethics and corporate governance. It promoted me to work towards achieving sustainable development, defending the rights of workers and employees, appreciating the role of the private sector in the development process, and obliging the business sector to comply with its social responsibilities.

*** How do you look at the performance and the importance of the role entrusted to the BSE, as a professional organization in the engineering sector?**

Since its establishment in 1972, the Bahrain Society of Engineers has been looking after the affairs of engineers in Bahrain, safeguarding their interests and developing their capabilities through technical and social programs. In this role, the BSE was able to achieve all its objectives in accordance with the statutes set by the founders.

This is evidenced by its continuous close relations with all ministries and government bodies concerned with the engineering sector, major industrial companies, and engineering companies working in the fields of engineering development and implementation. The Society and its members have accumulated unlimited engineering experience covering all disciplines of engineering in the Kingdom.

The BSE has recently celebrated its fifty years anniversary and the world has witnessed significant changes in the engineering and technology spheres over the past decades while the engineering requirements in Bahrain have also seen rapid changes as a result of urban expansion, population growth, and the new legislation related to the engineering profession. Due to all such changes, the objectives of the BSE need to be reconsidered, and to urge the Government to allow the BSE to play a greater



Dr. Osama Al Baharna is among a group of Society members on a technical visit to Khalifa Port and Bahrain International Investment Zone - January 22, 2011.

role in the field of legislation, control, professional accreditation, training, qualification, and regulation of the engineering practice. The role of the BSE must not be less than the role played by similar engineering professional associations in our GCC neighboring countries.

I also hope that the legislative obstacles that limit the ability of the BSE to invest its funds and grow its revenues will be removed to allow it to provide unique and advanced services to engineers. This may include health insurance, optional pension insurance, special financing facilities, support for small and entrepreneurial engineering projects that encourage the young engineer to be creative, and motivate the BSE to assume greater social responsibilities and develop the contributions of the BSE towards humanitarian work such as the restoration and rehabilitation of the homes of poor families, and increase the allocations of grants and scholarships to study engineering, etc.

I have no doubt that all the members aspire to turn the Society into an engineers' trade union with all the organizational and supervisory powers of the unions over the profession and engineers.

*** What are your most important participations in the field of volunteering work in general?**

My activities at the BSE have encouraged me to have other volunteering experiences in areas of priority to me in line with my interest and passion. In this line, I joined the Bahrain Society for Human Rights in 2011, and was elected to the Board of Directors of the Society in 2015. I participated as a representative of the Society in a number of related seminars and meetings locally, regionally, and globally. I continue to contribute to the activities of the Society for Human Rights as Vice Chairman of the Board of Directors.

This unique experience has provided me with the possibility of contributing to the field of sustainable development, and getting to know many activists in the field of human rights and workers' rights inside and outside Bahrain. I also took part in human rights and development activities in cooperation with organizations such as the Office of the UN's High Commissioner for Human Rights, the Bahraini Ministry of Foreign Affairs, the International Federation for Human Rights, the Bahrain Human Rights Foundation, the International Republican Institute, the National Democratic Institute, the General Federation of



With Dr. Dhiya Abdul Aziz Tawfiqi, the former president of the Bahrain Society of Engineers, and Eng. Imad Abdul Rahman Al Moayed, the former president of the Society, President of the Bahrain Society of Engineers Award for Distinguished Engineer, honoring Dr. Osama Al Baharna - March 2019.

Bahrain Trade Unions, the Bahrain Transparency Society and the Arab NGOs for Development.

Among my other interests in the field of commerce and business, I have had numerous voluntary contributions and activities with the Bahrain Chamber of Commerce and Industry. For years, I have been involved in working on various committees such as the Banking and Insurance Sector Committee and the Public Affairs Committee. I was appointed in 2018 as Chair of the Technology Committee and to date, I remain active in the Chamber's programs as an advisor to the Technology and Digital Economy Committee. One of my major contributions to the Chamber is participation in the planning and implementation of the Chamber's electronic system project (2018 to 2021), including the projects of the new system of accounts and customer service and the development of the Chamber's mobile application. This is in addition to organizing an annual conference entitled "Bahrain Tech Summit".

Among my many contributions to the Chamber are the organization of many lectures, seminars, and workshops in the field of technology, its applications,

and uses, the advantages of digital transformation of small and medium enterprises, the development and promotion of e-commerce, the skills of the future of the ICT sector in Bahrain, the development of the digital economy in the Kingdom, etc. As a result of the foregoing, my relations with a large number of businessmen and entrepreneurs were consolidated through my volunteer work at the Chamber. I also learned about the work and impact of a number of accelerators and incubators in Bahrain and participated in many conferences related to the development of trade and business inside and outside the Kingdom.

«My activities at the BSE have encouraged me to have other volunteering experiences in areas of priority to me in line with my interest and passion»



Dr. Osama Al Baharna during his participation in the meeting of the Chamber of Commerce and Industry delegation with Samsung - South Korea - November 2018.

I also have other contributions in the field of volunteering activities in my capacity as the Chairman of the Advisory Board of the Faculty of Engineering at Al-Ahlia University since 2017, Vice President of the Bahrain Society of Technology Companies from 2016 to 2021, membership of the Arab Federation for Information and Communication Technology, membership of the Bahrain Indian Society and working with the National Society for the Support of Education and Training.

***What are the hobbies that you love and practice, old and new? Has your job and engineering specialization had any impact on the educational path of your children?**

During my childhood and early young age, I was passionate about playing football like a lot of Bahrainis. I continued playing football during my school days in Canada on an almost daily basis, and with a group of friends, I always formed football teams to participate in student tournaments. While I was studying for my bachelor's degree, a professor introduced me to squash, and several years later I was able to win one of the

annual competitions for McGill University students. I also learned to ski in the same period as Canada's cold weather makes it imperative for you to engage in some winter activities that also help you integrate into society. I continued to play football and squash until 2009 when a multiple-shot leg muscle injury forced me to stop. However, I still practice ice skating when traveling during the winter period. I am also fond of reading history books, and books on today's affairs. I am not interested in reading novels other than science fiction novels and those about specific historical incidents or sites.

In 1993 I got married to Dr. Jamila Mirza Al-Mahari, a specialist in entrepreneurship studies, who taught at the College of Business Administration at the University of Bahrain until her early retirement in 2018.

I was honored by the presence of the late Amir Shaikh Isa bin Salman Al Khalifa, HRM King Hamad bin Isa bin Salman Al Khalifa, Crown Prince at the time, and the late Amir Shaikh Khalifa bin Salman Al Khalifa, Prime Minister at the time, to my wedding.



Dr. Osama Al Baharna with the delegation of the Bahrain Society of Engineers visit the site of the solar power plant of Tatweer Petroleum Company.

We have two sons and one daughter. The eldest boy “Alaa” studied mechanical engineering at Imperial College London and now works as an aerodynamics engineer with the Alpine Formula One racing team, owned by the French company “Renault” and based outside Oxford, Britain. In addition to his responsibilities in contributing to the development of the racing car's body, engine cooling system and racing simulators, he is involved in monitoring the vehicle's performance when racing is held both remotely from the workstation and at the race circuit.

My second child, Hisham, studied economics at the University of Chicago and now working in Washington City with one of the leading economic consulting firms. One of his tasks is to analyze economic, corporate, and market data to help large companies and international and governmental institutions overcome the difficulties that they face in their field of work, including antitrust and intellectual property. Our daughter, Noor, has graduated from the Bachelor of Accounting and Finance Program from City, University of London's Cass Business School, and now works as an auditor at Grant Thornton in London and she studying for the Association of Chartered Certified

Accountants (ACCA) certification.

We have allowed our children to choose their future and course of study without any pressure or interference. I believe that in today's society, the aspirations of young people and the challenges faced by our children are different from what we experienced. Today's generation is now experiencing a major information revolution, and they are accustomed to using social media and modern communication tools that we did not have before, equipping them to better identify their desires and explore their abilities at an earlier age than we were at the time.

*** Is there certain wisdom or sayings that you follow in your footsteps, what wisdom do you believe in and work with? And Why?**

I do not have a single wisdom to follow and work with, but I always try to be precise in my work and in performing my tasks, to do my best in fulfilling my commitments, and to deal with others in a moral and humanitarian manner. I also consider any failure to be a stage of growth, and I view any problem facing me as an opportunity to develop and excel. It is certainly unfortunate that I have broken these rules a number of



Dr. Osama Al Baharnah with his wife "Um Alaa", Mount Courchevel, France in February 2018.

times during my life and career. I may have sometimes got too excited when expressing my opinions to my colleagues and friends,

*** Is there certain wisdom or sayings that you follow in your footsteps, what wisdom do you believe in and work with? And Why?**

I ask forgiveness from those who have been hurt by me for any negative action or personal harm. I am a person who is characterized by tolerance and quick to forgive.

***During this long practical journey in the engineering sector, and the many people that you have worked with, do you have an idol or as a role model in this field?**

I have worked with many outstanding characters, some of them were in leading positions when I had the chance to know them, or were appointed in a later stage. I benefited from their knowledge and experiences, which I made sure they passed on to me. I learned a lot from

«We have allowed our children to choose their future and course of study without any pressure or interference».

them, especially in dealing with problems and crisis management, and how to manage teamwork effectively. I have also worked with a group of creative and highly technologically capable professional colleagues, but they did not have the opportunities to occupy leading positions for reasons more related to biases inherent in the hierarchical structure of organizations, yet they have been my role models in ethical handling and professional cooperation. I must recall also some of my previous dealings with a number of those who, in my view, did not deserve the trust of those who have appointed them.

My example in my personal and professional life is my father Taqi Mohamedd Al-Baharnah, whom I have always tried to emulate in his dream, compassion, morals, faith, ascetism, reverence, patience, professionalism, knowledge, sincerity, independence, dedication and love for his country.

*** There is no doubt that your career path in the engineering sector is replete with beautiful or influential situations that have left an imprint and influence on your personality, Could you share with the readers of the (Almohandis) one or more of them?**

I remember from some of the negative and expressive situations I experienced during different stages of my life that I was surprised by the ability of some to exploit the trust of others in them and without any



Dr. Osama Al Baharna with the Development Fund delegation to the (Web Summit) Conference and Exhibition in Lisbon, Portugal, December 2019

shame to achieve their own gains during my time at the university. I am still surprised by the intentions of some in different institutions to present themselves over those who are more competent, more capable, and more appropriate, rather than learning from them, becoming more diligent in their work, and seeking self-development. On the other hand, I passed through beautiful experiences that affected my personality and later my professional dealings. While I was studying for a bachelor's degree, I received a phone call from a Canadian bank asking me to work for them after graduation, and I confidently replied that I am a scholarship engineer sponsored by the government of Bahrain and that I must return to serve my country. Many of the professors I dealt with both while studying in Canada or UK treated me outside the classroom as a younger brother without any arrogance. I still recall the attitude of my manager in Canada when I deal with my employees, knowing about the possibility of a war in the Gulf, and worrying about my safety and about my future. I was amazed by the magnitude of personal sacrifices, dedication to volunteer work, and the primacy of the public interest by some of those I have dealt with in civic society associations, including some colleagues in the BSE.

***Finally, is there a word to say to young engineers or those who are about to study engineering?**

I have never regretted selecting the engineering

profession since it is a fruitful occupation, and for those who choose it as a career, it gives them the opportunity to develop themselves later and increase their chances of success in various fields, even outside the engineering scope.

My word to young engineers and others is to work hard to achieve success and they must seize opportunities from inside and outside the Kingdom. They need to develop their professional abilities with patience, serve others and society, ensure to build a strong network of relationships and be always helpful and cooperative.

«The BSE need to be reconsidered, and to urge the Government to allow the BSE to play a greater role in the field of legislation, control, professional accreditation, training, qualification, and regulation of the engineering practice».



**Eng. Mohammed
Al Asfoor**

The Four most important strategies Oil & Gas Companies should consider for Retaining Top Talents

One of the most challenging things the Petroleum Industry is facing currently, is how to recruit, train and retain top talents coming to the work force. I am talking here about the Millennial and Gen Z. This generation are not anymore expected to stay in one company or even one industry during their working life.

The Leaders and Managers in the industry shall be prepared and adapt their expectation and organizational structure for this new workforce that have new priorities.

Based on my 25 years' experience in the Petroleum industry, here are 4 most important strategies to consider:

1- Job Rotation

Young Generation enjoy the opportunity to rotate through several jobs during their first few years with a company. For example, a Petroleum Engineer at an operator company could spend 6 months in Workover operations, another 6 months in drilling operations and may be 6 months with Field operations and so on. This gives them the opportunity to identify what they like most and the path they want to pursue.

2- Give Space for Innovation

Leaders have to offer the current and new employees the space to pursue their passions and break some boundaries. This allows them to create a personalized path forward and feel connected to the company's future. Employees can clearly see how their experimentation can turn into something meaningful for the company, reinforcing their desire to be creative.

3- Flexibility

Many positions within the Oil & Gas industry require in-person work. However, because of COVID there is now powerful desire for Hybrid working schedule. This is true for especially younger employees who are thinking about life balance and family responsibilities. Hence, Leaders must ask themselves, "What can flexibility look like within the constraints of job requirements?"

4- Training, Development and Growth Opportunities

Companies should encourage the development of soft skills, critically thinking about what tools future leaders will need – such as handling change with adaptability, creativity, and compassion – then developing an appropriate training plan.

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Dr. S. M. Zakir Hossain

**Dept. of Chemical Engineering,
University of Bahrain, Bahrain**

Microplastics: New Cause of Serious Harmful Impact on Human Health

1. What are microplastics?

Plastics are used in a wide range of packaging products for food and industrial purposes due to their low density, low conductivity, and corrosivity, as well as serving as water and oxygen barrier. In bottled water, PET (polyethylene terephthalate), PP (Polypropylene), and PE (Polyethylene or polythene) are commonly used to make bottles and bottle caps (WHO 2019). Plastic items degrade and fragment over time due to natural environmental conditions known as Microplastics (MPs). These are tiny plastic particles ranging in size from 1 μm to less than 5 mm, consisting of a regular or irregular type of synthetic solid particle or polymeric matrix, commonly characterized as insoluble in water (see Fig. 1). Small plastic particles of less than 1 μm are usually called nanoplastics instead of microplastics. Humans now generate roughly 300 million tonnes of plastic waste annually. Nearly two-thirds of all plastic produced remains in the environment.

Most of it in the form of microplastics, tiny toxic particles polluting the air (invisible plastic particles floating in the air), soil, and rainwater. These eventually end up in animals and even humans via the food chain. The chemical toxicity of leaching MPs depends on the exposure route, e.g., ingestion, inhalation, or injection (WHO 2019). Moreover, their hydrophobic nature increases MPs' potential risk, which accelerates them to absorb chemical additives and harmful contaminants such as metals, PCBs (Polychlorinated biphenyls), pesticides, and other pollutants on their surface. Today, it is believed that there are 500 times more microplastic particles in the globe than stars in the galaxy, which is a clear indication of MPs pollution. In 2017, Belgian scientists announced that seafood lovers could consume up to 11,000 plastic particles yearly by eating mussels (a favorite dish in Belgium). A 2019 study estimated that an average American citizen ingests between 74,000 and 121,000 plastic particles yearly. Plastic particles can be found in bottled water also. The average number of microplastic particles is found to be 325 for every liter of bottled water (see Fig. 2). A great scientist, 'Koelmans', renamed MPs' pollution "a plastic time bomb".

2. Potential impact on human health:

Previously, the effect of microplastics on human health was unknown. However, in recent years scientists believed that MP particles could harm humans. Scientists announced that "we live in a multi-particle world". These particles can cause oxidative stress, tissue damage, and chronic inflammation in the human body. MPs absorption through the gastrointestinal tract can potentially create severe health effects. Furthermore, MPs may release toxic chemicals and pathogenic organisms that have been adsorbed on their surfaces. Bisphenol A (BPA), phthalates, monomers, or other additives (e.g., antioxidants, lubricants, pigments, antistatic agents, etc.) which are used in plastic, have gained the attention of regulatory bodies around the world, including US Environmental Protection Agency due to its high toxicity to the animal and humans. Previous studies investigated the presence of microplastics in organs that are exposed to microplastic and confirmed the presence of bisphenol A (BPA) in lung, liver, spleen, and kidney organs. It is alarming because these (MPs) compounds are

not biodegradable and can accumulate in human organs. Monomers and additives from the microplastic matrix may leach into the organism's tissues, exposing the tissues to endocrine disruptors (e.g., phthalates and bisphenol A). MPs can disrupt immune function, translocation, energy and metabolic disruption, neurological disorders, etc.

To date, certain adverse health effect on human is yet to be identified. Previous studies have shown that exposure to nanoplastic/microplastic can cause diseases in animals/humans, including infertility and cancer. Humans are also exposed to MPs via inhalation. Some studies strongly suggest that one of the causes of brain cancer is MPs from air pollution.

3. How to avoid MPs pollution?

It is almost impossible to avoid MPs pollution; however, some practical ways may reduce their spread and the risk of ingestion. These include: (i) avoiding bottled water and drinking filtered tap water instead, (ii) avoiding wearing synthetic clothes since high MP particles are found in synthetic clothes, and (iii) avoiding exfoliants and scrubs where possible, as they contain high quantities of **microbeads among beauty products**.

4. Regulations around the world for MPs in Water.

Regulations concerning MPs use, and disposal yet have to be developed. The majority of countries around the world do not have regulations in place. However, some countries have started to realize the importance of regulating the use of MPs. They have tried to use more biodegradable materials to produce plastic. For instance, in 2018, US Congress passed



Fig 1. Image of Micoplastics



Fig 2. Microplastic particles are released in bottled water

a Public Law prohibiting the sale of cosmetics with plastic microbeads. The Netherlands and Canada also have set some rules regarding microbead usage in the production of cosmetics and personal care products. The European Union (EU) has established regulations on marine litter and achieved a considerable

reduction in plastic bag usage. Furthermore, the EU is recently working on policies to effectively lower overall plastic packaging and ensure that all of it is

either reusable or recyclable by 2030.

The textile industry, instead, remains often overlooked despite its massive role in spreading microplastics worldwide; thus, immediate regulation is necessary. Moreover, according to the Austrian Ordinance on Waste-Water Emission, the upper bound for plastic release into running water is set to be 30 mg/L. The report prepared by SAM (2018) highlighted that the European Commission promoted access to tap water and encouraged EU citizens to use less

plastic bottled water. The regulation on biocides 32, which deals with chemical contaminants entering the marine water environment, also focuses on MPs presence in drinking water, their potential paths of release, associated risks, and remedial actions in case of potential danger to human health. Some European countries started to enforce policies and legislation related to marine litter. This includes legislation on environmental waste management, urban wastewater, and pollution from ships. Countries worldwide must unite to coordinate the waste management legislation in the broader context. New legislation related to the use of plastic products, particularly packaging, needs to be developed to mitigate the environmental impact of plastics.



Dr. Mostafa Ghassoul

**Assistant professor,
Chemical Engineering,
College of Engineering,
University of Bahrain**

Teaching automation (DCS, PLC, industrial networking), microelectronics (microprocessors and microcontrollers) as well as instrumentation to process instrumentation and control engineering.

Can we rely on ourselves in designing and building laboratory equipment for our engineering programs at reasonable cost?

University engineering education is very expensive, especially the practical side where laboratory equipment is generally imported at relatively high cost. Unfortunately, many universities in the region are still relying on this policy, adding to that high maintenance cost when it exists. By looking at most of the lab equipment, it comes in the form of black box with an executable software developed by the manufacturer and cannot be accessed or modified by the end user. This renders the benefit from the excise very limited. One area of interest where our engineering colleges can contribute in developing their own equipment is in the field of instrumentation, control, electrical engineering, electronic engineering, automation just to mention a few.

The reason being is the enormous advancement in technology over the last twenty years and the availability of microelectronic devices at affordable price. This short paper presents the design and realization of the popular three term controller (proportional-integral-derivative) based on a microcontroller and interfaced to either an alphanumeric liquid crystal display or to a graphic liquid crystal display. This controller is the mostly used in industry. It is used in closed loops and it is robust and could easily be implemented and can provide excellent control performance. To implement this type of control, computers are called upon. To use a computer for a single loop control is too expensive and bulky. An alternative solution is to use a microcontroller which costs only few dinars and fulfills the task perfectly. A microcontroller is no than a microcomputer in a single chip. The chip contains the central processing unit, a FLASH memory to store the program, a RAM to store the data and limited ROM which could be used to store look up tables. It has a number of timers/counters, analogue to digital converter connected to a number of analogue channels. It has a number of digital input/output pins. The controller could be connected to a low level local network such as Controlled Area Network (CAN). The crucial limitation is that most of microcontrollers

do not have any Digital to Analogue Converters. Luckily, several manufacturers have produced serial DACs which could be easily interface to Synchronous Peripheral Interface (SPI) through only two lines (synchronous clock and output data). Fig.1 shows a typical closed loop control system based on a microcontroller. The aim of the closed loop control is to bring the difference between the set point SP and the measured variable $c(KT)$ to zero. Unfortunately, that is not always the case, where a long-term error may persist. To kill this error, an integral action is required. The derivative action prevents the controller from driving the system violently to the new position with the change in the set point.

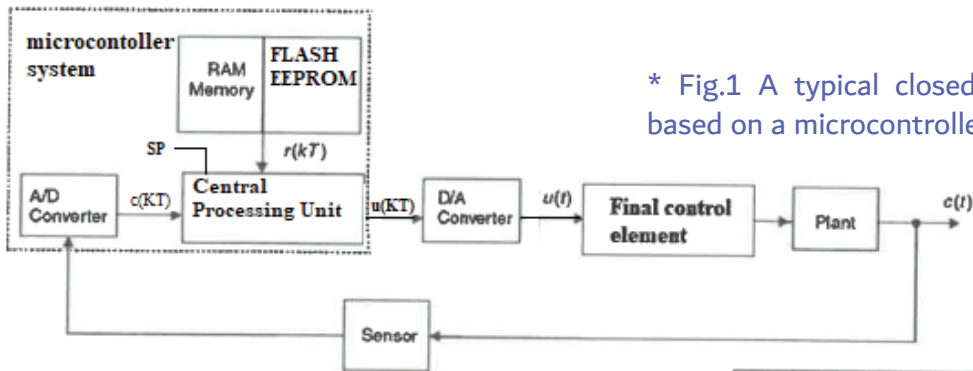
The digital error is given by:

$$e(KT) = SP - c(KT) \quad (1)$$

The digital form of the digital PID is given by equation (2):

$$PK = P \square + KC(e(KT) + T_S/T_i \sum_{j=1}^K e(jT)) + T_D/T_S \square (e(KT) - e((K-1)T)) \quad (2)$$

Where P_k is the control signal, $e(jk)$ is the error at instant jk , T_s is sampling time, T_i is the integral time constant T_D is the derivative time constant



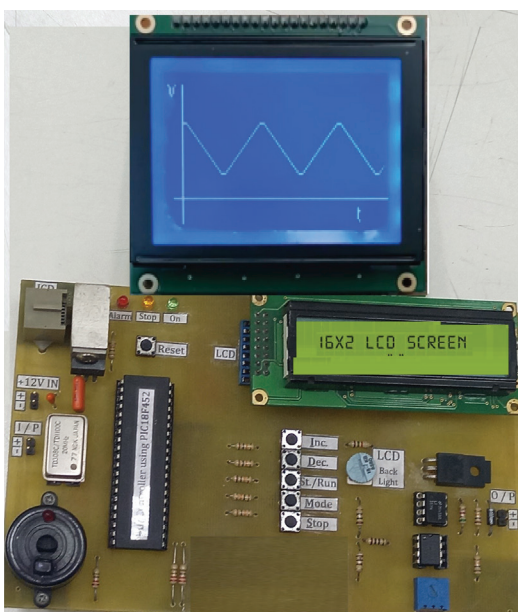
* Fig.1 A typical closed loop control system based on a microcontroller with external DAC

and K_C is the controller gain. This PID algorithm was implemented using C language on the MPLAB platform. The main problem faced was to output this signal to the system. A serial DAC was used. This converter is manufactured by microchip itself under the name MPC4921 as single channel output. The full circuit is shown in fig.2.

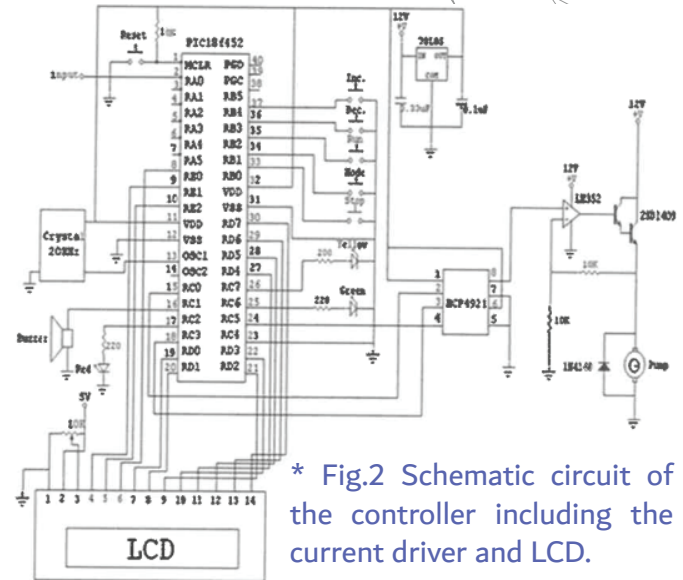
The results could either be displayed as numerical values using alphanumeric LCD or as graphs using the graphic LCDs.

A photograph of the printed circuit board of the system is shown in fig.3.

This experience could be pushed further by using higher performance microcontroller such the 32bits processor to implemented any complex control strategy such artificial intelligence, predictive model control, multi variable with aid of SIMULINK where microcontroller blocksets are available. We can add to the system a Human-Machine Interface(HMI) using any software such as EDRAW-MAX. we can also add



* Fig.2 Schematic circuit of the controller including the current driver and LCD.

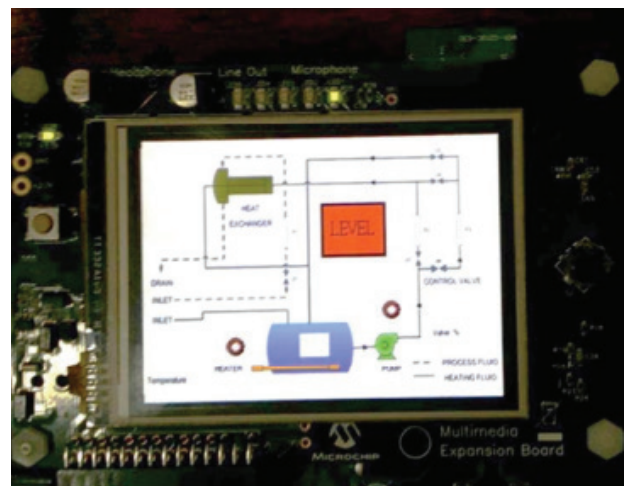


* Fig.2 Schematic circuit of the controller including the current driver and LCD.

soft icons to the system. An example developed using PIC32 microcontroller is shown in fig.4. realizing such projects, we will meet two objectives:

1- We develop our equipment and start from there for future development

2- We train our students to design, build and test equipment which will be beneficial in their future carrier.



* Fig.2 Schematic circuit of the controller including the current driver and LCD.

Spatiotemporal analysis for land use and land cover in the Kingdom of Bahrain

Project team:

Juwana Jamal Alsaedi

Adviser:

Dr. Khalil Aljaboori

Introduction:

The objective of this project is to measure the extent of urban expansion in Bahrain during the period from 1980 to 2020. By conducting a comparison every 5 years, the increase in urban areas and the direction of this increase are determined.

This project is based on confirming the existence of rapid time changes in land use, and it is expected that this research will help in finding temporary solutions, and planning for the future to avoid this problem.

In this project, I used the ArcGIS program, which analyzes the areas, and separates the areas from each other according to the different use of these lands. In this paper, the focus will be on urban areas.

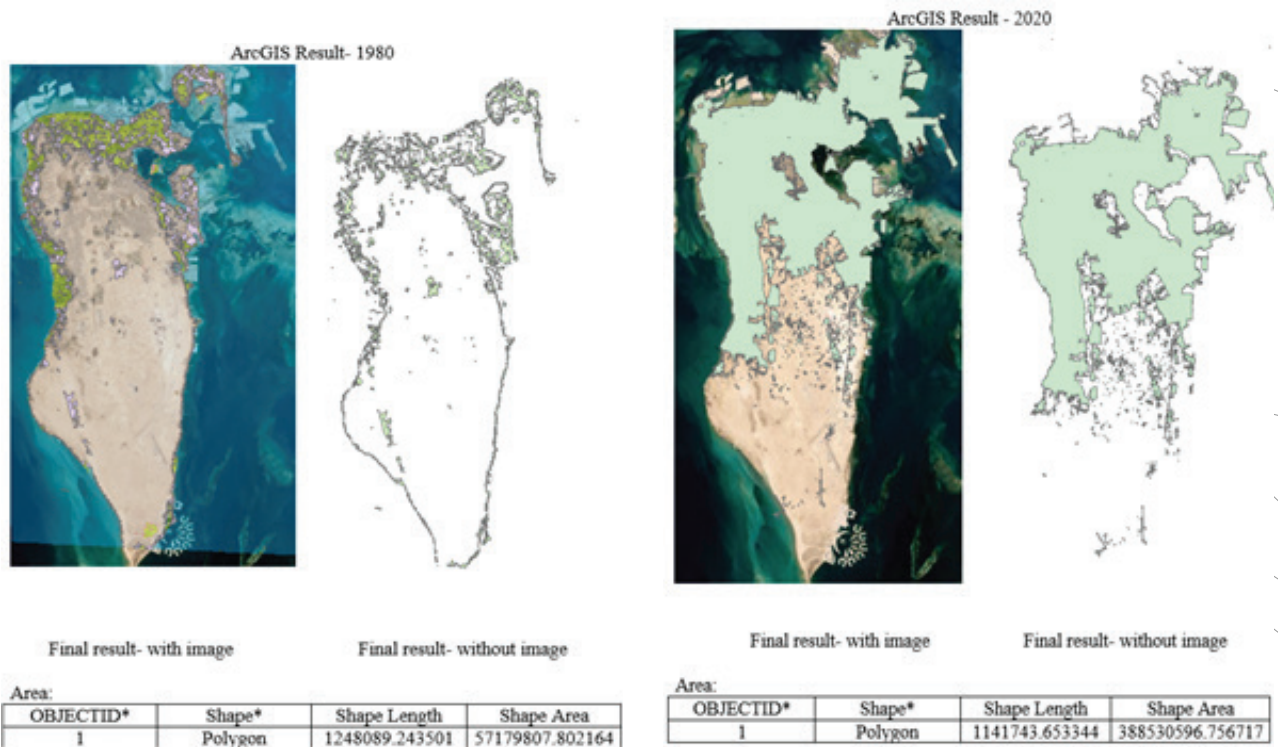
Methodology:

In this project the type of data that has been worked on, are satellite images. There are many satellites, and each of them is symbolized by a number. The higher the satellite number, the newer the satellite. And every satellite has something called 'Bands' and this 'Bands' also containing numbers, a combination of the different numbers of the 'Bands' is formed to get the clearest possible result for defining specific areas.

After obtaining satellite images through the USGS program. Work was carried out on nine maps of the Kingdom of Bahrain from 1980 to 2020, and the method of comparing maps was followed for every five years. In the satellite images that were extracted, parts of the Kingdom of Saudi Arabia and the State of Qatar appeared, the next program that was used is ArcGIS The parts of the countries not targeted in the study were cut, and this process is called 'Mask'. After creating the 'Mask', it is combined with the satellite image for each year and to find the proportion of the urban area.



*Figure 1 : Bahrain map 1970 (Before any changes)

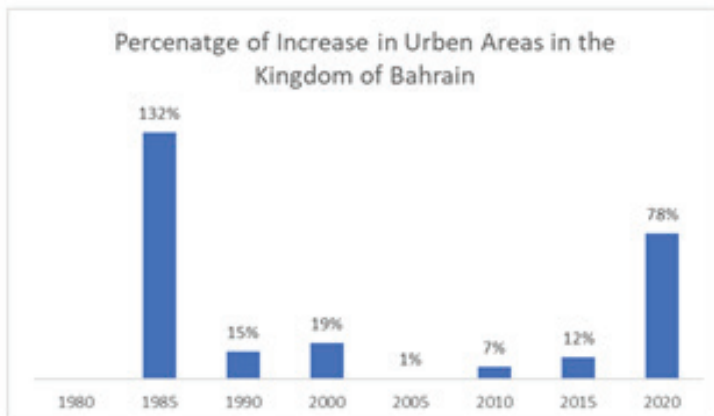


*Figure 2: Pictures of the map of the Kingdom of Bahrain in the first year it was studied and the last year, and the percentage of urban area in the two years .

percentage of increase

Year	Urban area	Percentage
1980	57,179,807.80	
1985	132,790,675.49	132%
1990	152,438,697.50	15%
2000	181,990,835.59	19%
2005	183,032,766.76	1%
2010	195,177,583.53	7%
2015	218,028,215.55	12%
2020	388,530,596.76	78%
	AVERAGE INCREASE	31%

percentage of urban expansion



Conclusion:

The topic of the project is very useful to find out the reasons of some of the most critical problems in Bahrain which is the sudden un-planned crowded in all the facilities of the country, in addition enable future to avoid any similar situation.

Design of bird hazard mitigation system (BHMS)

Project team:

Fatima Ali Abdulla
S.Mohamed Taqi
Qasim Yaqoob

Advisers:

Dr. Salwa Baserrah
Co-supervisor Name:
Mr. Mohamed Sadeq

Abstract:

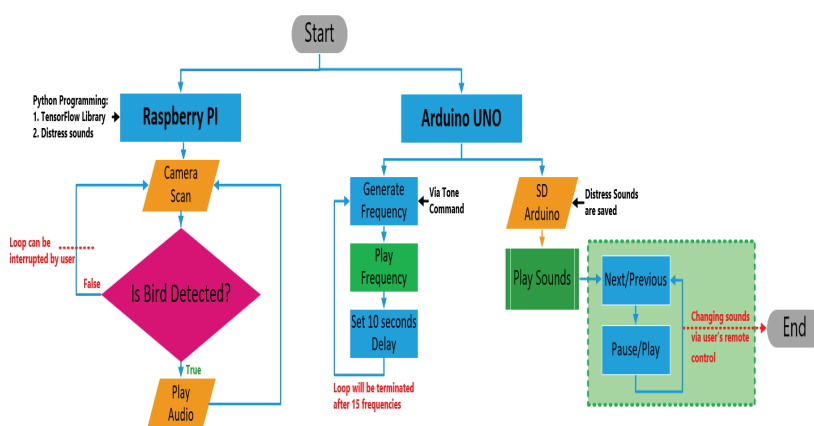
Bird strikes are well-known worldwide and have a significant impact on aircraft damage while in flight. And, as technology advances, there are more options for keeping birds away from aircraft. Because bird strikes are most common during airport takeoff and landing due to the low altitude of the aircrafts at that time of flight, the basic solution is to keep birds away from the airports. The Raspberry Pi and Arduino are used to create the Bird Hazard Mitigation System (BHMS), with the Raspberry Pi detecting birds and playing distress sounds and the Arduino generating frequencies and playing distress sounds.

Design and Implementation

BHMS was designed using two approaches. The first is Artificial Intelligence (AI) technology, which was implemented using a Raspberry Pi and a high-resolution camera, as well as TensorFlow. Because the program is written in Python, all the necessary libraries were included to play the distress sound after the bird was detected. The second method involves using an Arduino microcontroller to play saved distress sounds via a remote control. In addition to using the tone command in Arduino to generate frequency tones.

Conclusion

The Bird Hazard Mitigation System (BHMS) prototype worked well to deter pigeons gathering in any area, as determined by a simple pre-experiment. Artificial Intelligence has been thoroughly studied, as have tools such as TensorFlow and a variety of Python libraries. The project investigated three distinct scenarios: generated frequencies and playing recorded sounds via Arduino, and bird detection via Raspberry Pi, and BHMS is powered by solar energy. As it has been observed that it disturbs birds, an extra option of having a variable frequency controller will be added for future work. Furthermore, including all birds in the detection model would broaden the project's applicability to include more types of birds.





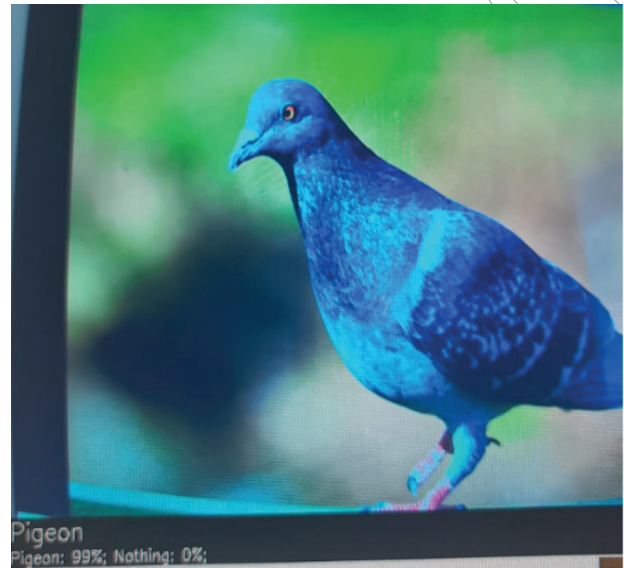
Objective and Motivation

Bird strikes are a worldwide issue in airports because birds are intelligent animals that quickly adapt to new solutions, rendering them obsolete. Furthermore, the Wildlife Department at the Bahrain International Airport informed us that conventional solutions are used in the airport because advanced methods are too expensive. As a result, it was a motivation to seek the most effective and affordable method of preventing bird strikes using technology and the economic system at the same time.

The objective of this project is to create an intelligent system that detects specific types of birds in Bahrain International Airport. If the system recognizes the type of bird, it will play a distress sound or high pitch frequency noise that will repel the birds away, and it will also have a secondary controller to operate the system without the need for object detection.

Results

An accurate artificial intelligence system is created that detects the presence of a bird and then plays a distress sound. The system includes three different methods that have been successfully implemented and tested on one type of bird, the pigeon. BHMS demonstrates its adaptability to deter other types of birds.



Camera Detection Using a Raspberry Pi and a high-resolution camera.



Enclosure of BHMS A box is designed to enclose all electronic components and facilitate the transportation of the prototype.

Replayed Voice Detector Using Generative Machine Learning Classifiers

Project team:

Najla Ahmed Abdulrahman
Dalal Samer Ali

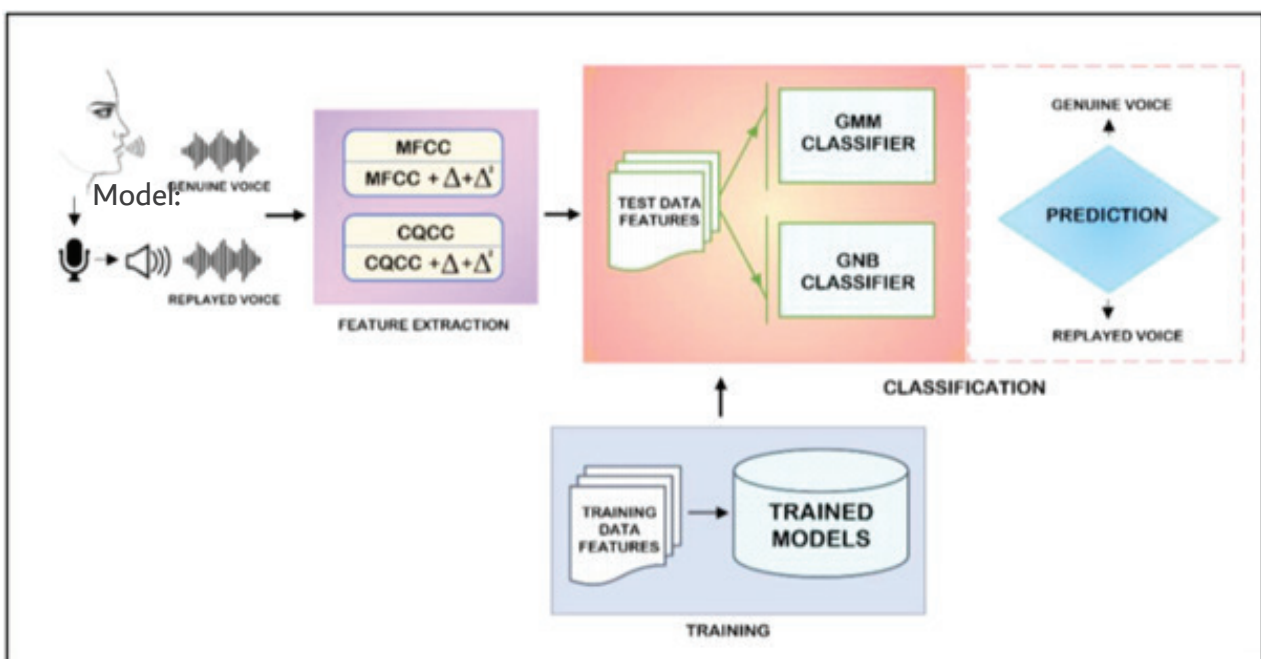
Sarah Alshareeda

Abstract:

This project presents an implementation of replayed voice detector models. The detector is a countermeasure against spoofing attacks performed on biometric security systems that utilize speech audio for authentication like the automatic speaker verification systems. The model's task is to perform pattern recognition to classify an input speech utterance as either a genuine speech class originating from a live source or a replayed speech class originating from a pre-recorded source. The classification in this project was performed using the Gaussian Mixture Model (GMM) and the Gaussian Naive Bayes (GNB) classifiers, which were used to train background models from extracted features of audio training datasets representing

both classes. The built classifiers' performance is estimated using the Equal Error Rate (EER) metric. We are challenging the built models against the development and evaluation datasets in various scenarios, of reduction and normalization, for the

goal of classification performance optimization. The obtained EER results of the GMM classifier are 11.2237% and 22.5429%, while for the GNB classifier, they are 14.3553% and 19.8722%, for the development and evaluation sets, respectively.



MATLAB real-time demo Implementation using the best result classifier : GNB classifier with normalization and reduction

Record the Voice

```

recObj = audiorecorder(16000, 16,1);
disp('Start speaking')
recordblocking(recObj, 4);
disp('End of Recording');

speechIn = getaudiodata(recObj);
plot(speechIn)

fmax = 16000/2;
B=96;
d=16;
cf=59;
Zsd0='Zs';

Cqcc = cqcc(speechIn, 16000, B, fmax, 20, d, cf, Zsd0
nor = [Cqcc]';

```

Prediction Output

```

MEAN_cqcc= mean(nor);
MEAN_cqcc1= cmvn(MEAN_cqcc, 'true');
Predictaed_label = trainedModel_best_gnb_cq_60_pca_35
%str= ['The voice signal is ', char(Predictaed_label)
%disp(str)
icondata= imread("ok.png");
Predictaed_label2= char(Predictaed_label);
if Predictaed_label2== "Genuine";

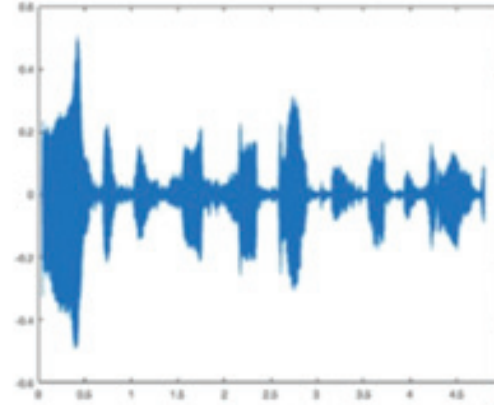
```

Start speaking

End of Recording

Prediction Result

✓
Genuine Voice Signal



This is an example for a real time genuine voice.

Record the Voice

```

recObj = audiorecorder(16000, 16,1);
disp('Start speaking')
recordblocking(recObj, 3);
disp('End of Recording');

speechIn = getaudiodata(recObj);
plot(speechIn)

fmax = 16000/2;
B=96;
d=16;
cf=59;
Zsd0='Zs';

Cqcc = cqcc(speechIn, 16000, B, fmax, 20, d, cf, Zsd0
nor = [Cqcc]';

```

Prediction Output

```

MEAN_cqcc= mean(nor);
MEAN_cqcc1= cmvn(MEAN_cqcc, 'true');
Predictaed_label = trainedModel_best_gnb_cq_60_pca_3
%str= ['The voice signal is ', char(Predictaed_label)
%disp(str)
icondata= imread("ok.png");
Predictaed_label2= char(Predictaed_label);
if Predictaed_label2== "Genuine";

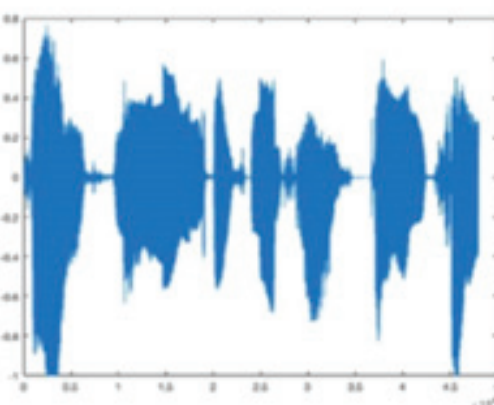
```

Start speaking

End of Recording

Prediction Result

!
Replayed Voice Signal



And this is an example for real time replayed voice



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