



KANS

Knowledge Application and
Notion for Society

Let's Do it Together

2022

KANS

COMPETITION FIELDS

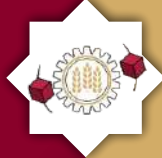
The competition is held in six different fields. Any scientific and technological achievement in the form of Idea, Paper, Book, Prototype, MVP, or New Product is acceptable.

About KANS 2022

The Mustafa^(pbuh) Science and Technology Foundation has established a scientific competition called KANS: Knowledge Application and Notion for Society. This competition has been staged with the aim of bouncing ideas around in academic community to address the problems of the Islamic world in different fields; such as Agriculture & Food Industries; Health & MedTech; Energy, Water & Environment; Electronics & Robotics; ICT & Artificial Intelligence; Mining and Mineral Industries. Scholars, researchers, innovators, university students, and instructors under 45 years of age are invited to submit their scientific and technological ideas and achievements in the form of a 5-minute video.

Future Stars

Future Stars is a special section in the third round of the KANS Scientific Competition. This section is for researchers, innovators and academics under the 30 years of age and is an arena for the competition of the younger participants of KANS. The scientific works of these participants, not only participate in the main competition and has the chance to win the awards, but also can compete once again with the other participants under 30 years of age. The winners of this section, in addition to winning the "Future stars" competition, will also enter directly into the final of the main competition.



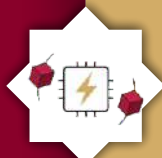
Agriculture & Food Industries



Health & MedTech



Energy, Water & Environment



Electronics & Robotics



ICT & Artificial Intelligence



Mining & Mineral Industries

Co-Partner:



Partners and Sponsors:



KANS Pavilions

Pavilions are national or international institutions that are involved in the field of science and technology in different Islamic countries which declare their local challenges and invite scientists and innovators from all over Islamic world to answer the challenges. In other words, pavilions are seekers and young scientist are solvers. Hence, KANS is not only a competition but also a marketplace, in which scholars and innovators may find an overseas customer for their idea, prototype, MVP, or new product.

Awards of six winners

A) Six winners will receive:

- ◆ KANS Medal & Plaque of Appreciation
- ◆ 30-gram Gold Insignia
- ◆ Special privileges for benefiting from MSTF networking platforms as well as Young Scientists Fellowship Program (YSFP) worth \$2000.

B) Every solution for challenges declared by international institutes will be handed over to relevant institute in order to cooperate and commercialize the solution, if desired.



The "Challenges Section" or "Free Section"?

If your achievement is a response to one of the challenges listed in this catalogue, mention the full title of the challenge in your video, otherwise you can participate in the free section of the competition.

Agriculture & Food Industries



A&F 1



Pakistan National Science & Technology Park

Subject: Agriculture Disease Monitoring and Prediction Tool

With a continuous rise in Pakistan's population, it is essential to increase crop yield to combat imminent food security. The survey of the last five years (2015- 2020) shows a decrease in the rate of production of the wheat crop from 2.2% to 0.5%. The main reasons behind these production losses are poor crop management, weather variations, and the attack of several diseases such as rust, tan spot, black chaff, etc. Wheat rust is the most hazardous disease which can cause a severe deficit in the wheat production rate, leading to a threat to food security in Pakistan. Its first attack can be spotted in the fourth week of February in different districts of Punjab, which affects almost 2.88% of the total Wheat crop. After the first appearance, it rapidly spreads and damages almost 30% of the crop within a month.

The Challenge: To identify the rust attack in the early stages so that remedial actions could be performed timely to minimize the loss caused by the rust.

A&F 2



Pakistan National Science & Technology Park

Subject: Fruit Orchard Spraying Vehicle

Orchard Spraying Vehicle contains the design and fabrication of a semi-autonomous fruit orchard that is capable of adapting to agricultural field terrain. The user is capable of controlling it and steering it with the help of a joystick and spraying around the fruit orchards efficiently and with better speed. Orchard Spraying vehicle provides our farmers the ease and reliability to increase the yield of fruit crops and improve the quality with the effective spray management system. Also, the quality of the fruit will also be increased which can help in improving the export quality of fruits, increasing the gross margin of our export fruits.

The Challenge: Wastage of 1.8 million Tons of fruit which grows into wastage due to ineffective spraying system. This is almost a loss of \$1 billion USD annually which could be a very helpful addition to our agricultural economy.

Agriculture & Food Industries

A&F 3



Pakistan National Science &
Technology Park

Subject: Early Disease Detection in fruit plants using deep learning

Pakistan's economy mainly depends on agriculture where 25% of the gross domestic product mainly depends on it. Around 60 to 70% population of rural areas is dependent on agriculture. In the coming years, agriculture will continue to be the most important factor in our country's economy. Traditional techniques are used to monitor crop fields, which is time and resource-consuming. The problem for farmers is to early detect the disease that affects crop production and sometimes damages a large section of the field.

The Challenge: Optimize crop production, using technology together with traditional methods to enhance farm monitoring.

A&F 4



Pakistan National Science &
Technology Park

Subject: Livestock Monitoring System

Increase in livestock infectious diseases, heat stress, impact on quality of feed crops and forage, and most importantly decreased animal production. This is a vicious cycle and demands focused attention to alleviate food insecurity, and climate change and drive precision agriculture practices in Pakistan for sustainable livestock farming.

Additionally, livestock farmers face a plethora of problems pertaining to day-to-day operations, such as:

- 1) No real measure of animal activity
- 2) High animal mortality rate mainly due to lack of health tracking.
- 3) Location tracking, if a farm animal runs off or is lost.

The Challenge: A system is required for monitoring the health and physiology of an animal and contributes to alleviating the harmful effects of infectious outbreaks by providing cost-effective diagnostic methods.

A&F 5



Pakistan National Science &
Technology Park

Subject: IoT- enabled Integrated Agriculture Station

Development of an integrated system to measure high-resolution real-time soil and environment-related parameters.

Development of indigenous low-cost soil moisture sensing technology for farmers. Integration of AI-related techniques for crop yield maximization. Provision of mobile app/web app for information collection and dissemination to the farmer

The Challenge: System to monitor the soil and environmental parameters such as Soil Moisture, NPK, PH, air quality, temperature, humidity, CO2 emissions, atmospheric pressure, and most importantly wind speed, direction, and rain level.

Agriculture & Food Industries

A&F 6



Mazandaran Science &
Technology Park

Subject: Agricultural & Food Science & Technology

Mazandaran province is the main agricultural hub in the country and is one of the main suppliers of strategic products such as rice, wheat, citrus fruits, as well as livestock and poultry. Also; presence of large food, meat and dairy factories in this area has created many capacities in this region. Therefore, the use of new technologies is very important, especially in the field of transformation industries, but the correct management of resources has created challenges in this field.

A&F 7



Semnan Science &
Technology Park

Subject: Microalgae Production and Maintenance Challenges

1) Due to high temperature fluctuations throughout the year and also during the day and night, it requires continuous and high-precision control of the water temperature and microalgae cultivation environment.
2) The microalgae growth environment and the high price of its design and preparation have increased production costs. The culture medium is analyzed and investigated in several ways, including bacterial, fungal contamination, etc., so that it is not contaminated after harvesting, and also to impose a lower cost for replanting and return to the cycle of use.

Proper formulation of the cultivation environment should be done according to the water used for greater productivity and reduction of initial planting costs.

3) Absence of domestically produced devices with appropriate use and the high price of importing these devices for the processing of microalgae, such as the device for extracting the active ingredient of the product.

A&F 8

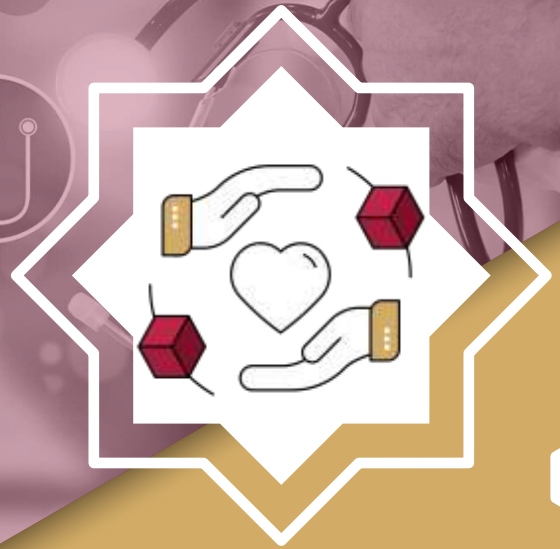


Semnan Science &
Technology Park

Subject: Lack of Sufficient Amount of Dissolved Oxygen in Water (The first limiting factor in increasing the production capacity of aquatic animals)

In conventional methods of aeration, it is not possible to provide sufficient oxygenation for intensive cultivation. Therefore, the use of aeration methods with a high oxygen transfer rate can solve this problem to a large extent and increase the amount of oxygen to the supersaturated state.

Health & MedTech



HTC 1



Commission on Science and
Technology for Sustainable
Development in the South

Subject: Emerging Issues of Antibiotics and Antimicrobial Resistance Genes in Pakistan

Overuse of antibiotics has caused the emergence of antibiotic resistant bacteria (ARBs) and antibiotic-resistance genes (ARGs) which are threatening the health of humans, animals, and the environment. Pakistan - a highly populated country with 70% population living in rural areas, is heavily dependent on agriculture activities. Overprescribing or unregulated use of antibiotics has been noted in both humans and animals in Pakistan. Reports suggested that 71% of infections in newborns in Pakistan are due to ARBs. Up to 95% of the adult population living in India and Pakistan carries bacteria resistant to β -lactam – one of the most common antibiotics that includes penicillin and cephalosporin. Despite the volume of antibiotics used in Pakistan, little information is available regarding the ARGs spread and management. For better management of antibiotics use, ARBs and ARGs, knowledge about their occurrence, abundance, and diversity is important.

The Challenges: Establishing spatiotemporal variations of antibiotics and antibiotic resistance determinants, Identifying potential mechanisms for transfer of ARGs from livestock farms to clinics, Characterizing fate of antibiotics in the soil environments with varying microbial communities, Identifying simple but key intervention strategies that can be adapted in Pakistan to reduce the burden of ARGs.

HTC 2



Universiti Pendidikan
Sultan Idris

Subject: Artificial intelligence in pharmacy

Artificial intelligence (AI) can provide solutions to many of the challenges facing the health care systems of the Islamic world. The use of AI technologies is expected to assist early diagnosis of chronic diseases, analysis of clinical data, patient monitoring and compliance. Most global healthcare companies are investing in AI strategies to discover new drugs for chronic and oncology diseases. It is estimated that the use of AI in pharma could generate \$100B per annum in the USA only.

The Challenges: How can AI be used to modernize Islamic world health care systems in one of the following pharmaceutical fields?

- New drug design and discovery,
- Patient data analysis and clinical trials
- Drug prescription and drug dosage optimization
- Remote patient monitoring

HTC 3



International Center for
Chemical and Biological
Sciences

Subject: Artificial Intelligence and Brain Tumor Imaging

The first step in treating patients with brain tumor is to remove as much of the mass as possible through surgery. A sample of tumor mass examined during surgery not only helps to precisely diagnose the tumor, but also aid in defining the margins between healthy and tumor brain tissue. The intraoperative diagnosis is essential for providing safe and effective care during cancer surgery. Nonetheless, intraoperative pathology analysis takes time, including sample processing, staining, and analysis by a pathologist, and during this time the surgeon and patient both have to wait for the results. A new study shows that a process that combines an advanced imaging technology and artificial intelligence (AI) can precisely identify brain tumors in less than 3 minutes during the surgery. The approach is able to accurately distinguish tumor tissue from healthy tissues. Optical imaging and AI are making brain tumor diagnosis quicker and more accurate. Computers are trained to “see” the patterns of disease hidden in cells and tissues. The remarkable use of computer-generated AI is quickly providing neurosurgeons with valuable, real-time information about the type of brain tumor, while the patient is still on the operating table. In operating room, faster also means more affordable. The researchers are also using an AI algorithm called a deep convolutional neural network to learn the characteristics of the 10 most common types of brain cancer and predict diagnosis. Thus, today neurosurgeons can leave the operation theatre with assertiveness than before about their patient’s brain tumor diagnosis because this application of AI allow them to quickly see diagnostic tissue and tumor margins in near-real time. This means neuropathologists can review the images without the need for a pathology lab, eliminating the long wait time.

The Challenge: How can Artificial Intelligence Speeds Brain Tumor Diagnosis?

HTC 4



Pakistan National Science &
Technology Park

Subject: Nanosensors for Cancer Detection (Biomedical Applications)

Nanosensors has attracted tremendous attention in biosensing applications because of the flexibility in the design, automated, high multiplexing capabilities, precise manipulation of fluid flow with small volume of samples, simple alignment setup, and high sensitivity. Chip-based biosensors, in particular, are promising tools for the early detection and analysis of infectious diseases biomarkers, virucidal drug evaluation for the applications such as clinical cancer/tumor diagnosis, environmental monitoring and drug discovery. In recent years, these biosensors have attracted scientific interest due to their miniaturisation, biocompatibility, high transparency, high throughput analysis, and cost-effectiveness. However, the critical parameter of sensitivity is below the benchmark for these biosensors. Hence, in context of nanotechnology materials, it is necessary to design and fabricate an ideal biosensor that would be minimally-invasive, and provides in situ and real-time sensing in order to facilitate precise result in real-time, in vivo transdermal biosensing environment with high sensitivity.

The Challenge: Micro- nano biosensors have been broadly used for point-of-care diagnosis of various cancer and infectious diseases but challenges are either screening process is unreliable, lengthy or cancer detection products are expensive and rarely available only in international markets. Thus, there is a huge potential in local market of Pakistan and rest regions of the World for the production of nanotechnology products

Health & MedTech

HTC 5



International Center for
Chemical and Biological
Sciences

Subject: Artificial Intelligence and Retinopathy

The figure of individuals with age-related ophthalmic diseases is on the rise, and considered as a central cause of vision loss in the elderly age group. Cataract is still the key cause of visual impairment and blindness worldwide, but other age-associated ophthalmic diseases, including AMD, diabetic retinopathy (DR), and glaucoma, are not much less in developed countries. According to World Health Organization (WHO) most recent published report, approx. 2.2 billion people have a near or distance vision impairment, globally. The majority of people with vision impairment and blindness are over the age of 50 years; however, vision loss can affect people of all ages. The use of AI in various fields of medicine holds promise for massive screening program and perhaps helps in establishing a diagnosis with high sensitivity and specificity. The technology is not very new, and its application is expanding in various subspecialty of ophthalmology. The capacity to build complex computing to execute pattern recognition of different vision threatening conditions by developing intricate relationship based on providing image data and then evaluating it with performance standards. Unfortunately, the existing technology fail to detect associated multiple conditions for instance glaucoma and AMD, while screening for a particular serious sight-threatening condition such as DR. Considering the overwhelming incidences of various sight-threatening disorders, such as AMD, glaucoma, and cataract, with age, massive AI technology-based screening program is required with high accuracy to delay or prevent blindness in susceptible individuals. An algorithm is needed to involve deep learning (DL) and add decision-making capability in the technology. The required software must be highly proficient in distinguishing all the necessary parameters of AMD, glaucoma, and cataract while screening process, and make proficient diagnosis in a cost effective manner. In addition, the technology facilitate ophthalmologist in monitoring respond to treatment with great accuracy.

The Challenge: How can Artificial Intelligence (AI) technology help in the screening and diagnosis of vision threatening conditions in various age groups?

HTC 6



Pakistan National Science &
Technology Park

Subject: MicroRNA Therapy for RNA viral infections

MicroRNA binds the single-stranded RNA with sequence compatibility and degrades it using cellular machinery. This strategy will help combat Corona, Dengue, EBOLA, Hepatitis C, and Influenza Virus.

The Challenge: An innovative strategy to kill ssRNA viruses.



Subject: Towards Automated Medical Coding with Knowledge Graph and Explainability

Automated Medical coding (AMC) aims to automatically convert Discharge Summaries into alphanumeric codes such as the International Classification of Diseases (ICD), Current Procedural Terminology (CPT), and the Healthcare Common Procedure Coding System (HCPCS). The absence of domain-specific knowledge in Computer-Assisted Coding (CAC) Applications built with Machine Learning and Deep Learning techniques leads to false-positive results. Knowledge Graph creation requires domain experts and is yet a manual approach which is a highly time- consuming and labor-intensive task.

The Challenge: A trustable Clinical Decision Support Systems (CDSS) for Oncology- related issues.

Energy, Water & Environment



EWWE 1



Commission on Science and
Technology for Sustainable
Development in the South

Subject: Plastic and Micro-plastic Pollution in Pakistan

In today's world, plastic is an essential raw material. Since their invention in the 1930s, plastics have become ubiquitous in the manufacture of everyday products. Plastic and Micro-plastics are particularly problematic and could pose big threats. Micro-plastic are either released directly into the environment or formed by the degradation of larger plastic debris. Once enter the environment microplastics could pose serious threat to aquatic and terrestrial ecosystems. In Pakistan the freshwater and marine water ecosystem receive huge amount of microplastic which is not only deteriorating the quality of water but also affecting the aquatic life.

The Challenge: How to reduce the microplastic pollution in water bodies in Pakistan?

EWWE 2



Commission on Science and
Technology for Sustainable
Development in the South

Subject: E-waste Pollution in Pakistan

Electronic products viz such as mobile phones, capacitors, wires, computers, television sets, transformers, and cables at the end of their lives are known as electronic and electric waste (e-waste). E-waste or electronic waste is created when an electronic product is discarded after the end of its useful life. The rapid expansion of technology means that a very large amount of e-waste is created every minute. Massive accumulation of these devices has generated major public health concerns due to the presence of toxic chemicals in them. Many of these electronic products contain inorganic and organic toxic chemicals to which humans may be exposed during both the recycling and disposal phases of these devices if suitable precautions are not taken. Informal processing of e-waste in developing countries can lead to adverse human health effects and environmental pollution.

The Challenge: What are the sustainable solutions to manage the e-waste pollution in Pakistan?

Energy, Water & Environment

WE 3



Khazar University

Subject: Cleanup of oil-contaminated soils

Currently, there are more than 30,000 hectares of oil-contaminated land on the Absheron peninsula. At present, a large number of expenses are required to clean up these lands. The breakdown of oil in the soil and its absorption by microorganisms can contribute significantly to solving this problem. Therefore, the development of bioremediation technologies in oil-contaminated soils is required.

WE 4



Khazar University

Subject: Development of small-scale wastewater treatment technologies

It is not economically profitable to connect the mountain villages of Azerbaijan to centralized wastewater treatment networks. On the other hand, rural houses located along mountain streams contaminate drinking and clean water sources, thus polluting very valuable water sources. Therefore, it is necessary to develop very low-cost wastewater treatment technologies that can be used at the household level. according to the task, researchers have to create small, portable, devices that allow to clean sewage.

WE 5



Khazar University

Subject: Development of technologies for POPs pesticide destruction

POP pesticides from the Soviet era are the main persistent organic pollutants in rural areas of Azerbaijan. The degradation of these organic pollutants remains a major challenge. Technologies are needed to facilitate the rapid degradation of POP pesticides.

WE 6



Khazar University

Subject: Role of clay minerals in gas emission of mud volcanoes

Global gas emission from mud volcanoes is ~ 15.9 Tg/yr- during quiescent periods and ~ 17.1 Tg/yr during eruptive periods, and the gas is mainly dominated by methane. Studies showed that methane emissions from terrestrial mud volcanoes during quiescent and eruptive stages significantly influence the atmosphere. Therefore, it is important to understand the geochemical process that controls the methane formation in mud volcanoes. It is known that mud volcanoes consist of clay minerals and organic matter. The clay minerals can play a key role in the transformation of organic matter into methane. The project aims to understand clay minerals' catalytic role in changing organic matter in mud volcanoes.

Energy, Water & Environment

WE7



Universiti Pendidikan
Sultan Idris

Subject: Land use conversions and environment issues

Land use conversion for the expansion of agricultural land, residential, commercial, road networks, mining, and other development activities are the most common triggers of environmental issues in Malaysia. These land use conversions are commonly associated with the degradation of natural habitats leading to human-wildlife conflicts, increase flood intensity, escalate environmental pollution, rising issues of food and water security, and the emergence of new diseases. At present, Malaysia is requiring formulations for sustainable, effective and viable land use management.

The Challenge: Propose a sustainable, effective and viable land use management to minimize the effects of land use conversions without compromising the economic benefits and social well-being.

WE8



Universiti Pendidikan
Sultan Idris

Subject: Obtaining clean water after an emergency

In the midst of rapid global climate change, Pakistan has been hit by the most devastating flood the country has ever faced in more than a decade. Tens of millions of people were affected when the monsoon rains continued since last June 2022, resulting in floods that submerged a third of Pakistan. The disaster has claimed more than 1,100 lives, destroyed many crops and damaged or destroyed more than a million homes. This also resulted in a critical supply of clean water to the remaining survivors and surrounding areas. Although having received some support from various countries, the victims of the flood still need tons of help.

The Challenge: Provide ideas that could utilise cost-efficient and eco-friendly technology in providing clean water to the victims in Pakistan.

WE9



Sharif Policy
Research Institute

Subject: Commercialization of weather data (creating a start-up)

Weather data is a key factor in good governance. The country's weather information infrastructure is a type of data infrastructure that is developed in order to collect, update and share weather information. This data infrastructure includes: laws and policies, standards, organizations and people, access networks and data. Therefore, it is considered one of the vital infrastructures in every developed country, with the help of which it is possible to help the micro and macro decisions of the country; including flood prevention and forecasting, protection of crops, estimation of water reserves, etc. So that the development and implementation of sustainable water management strategies requires access to reliable data with appropriate accuracy and appropriate temporal and spatial scale. Currently, at the country level, various institutions such as the National Meteorological Organization, the Ministry of Energy, etc. are responsible for collecting and storing data and information, and each of them continues their activities independently with different efficiency, and the investigations carried out show inappropriate performance in some of them. The processes of data release are in the mentioned organizations, but what is clear is that the budget of government institutions for the development of this web service is very limited, and it should be done with the help of data economics to commercialize weather data. Therefore, improving the development of the national weather data dissemination infrastructure and the ease of using such a system increases the probability of success in the dissemination and sharing of meteorological data in the country. The planning and implementation of such a system requires a broad vision and steps that meet the needs, resources and structure of organizations well.

Energy, Water & Environment

WE 10



Sharif Policy
Research Institute

Subject: Managing water resources in the countries of the Middle East region and its geopolitical effects on the intensity and extent of dust occurrence

The issue of water and shared watersheds in West and Southwest Asia is one of the current challenges of this region. The consequences of the problems caused by the physical and economic lack of water at the level and extent of the countries of this region have been clearly visible in recent years. The expansion of the level of dust production centers and the intensity and frequency of dust storms in the countries around the Persian Gulf, including the current consequences, have affected 183 million people living in 8 countries around the Persian Gulf. According to the statistics of the International Monetary Fund in 2020, at least four of its countries are among the 25 richest people in the world based on GDP per capita (purchasing power parity), but their quality of life in terms of environmental indicators and exposure to dust storms ranks It is lower.

WE 11



Sharif Policy
Research Institute

Subject: Ecological and climatic migrations

The human population is placed in an ecological context that supports and also limits human activities. Migration, as one of the types of human actions, expresses the relationship between humans and the environment. Human population movements have been closely related to ecological changes, both cumulative and acute. Permanent or temporary migration has always been one of the most important survival strategies adopted by human societies and individuals in the face of natural or human disasters. However, our knowledge of the complex two-way relationship between environmental changes and migration is still limited.

Iran is one of the countries that is most affected by climate change due to its geographical location due to its location in the dry belt of the world, the decrease in rainfall and increase in temperature, which are considered to be the most important indicators of climate change, in some parts of the country, lead to permanent migrations and It is seasonal.

The migrations that occur due to the occurrence of ecological crises will be mostly family and rural and founding and will cause the evacuation of villages. Researchers have mentioned the effects of climate change on migration as climate refugees. According to Seyedah Elham Azizi, the head of the climate change group of the Environmental Protection Organization (1401), no scientific research has yet been conducted to show how many residents of the Iranian plateau have migrated permanently or seasonally due to climate change. Therefore, obtaining comprehensive information on the amount of ecological migrations and investigating its causes and effects will be one of the scientific challenges that we are facing in the think tank.

WE 12



Islamic Network on Science
and Technology Parks

Subject: Rehabilitation of Anzali Wetland and Repulsion of Invasive Species

Anzali Wetland is the habitat of many species of aquatic animals, birds, plants, and one of the valuable ecosystems of the world. In recent years, what is considered a severe threat to Anzali Wetland and has exposed its life to destruction and drying is the invasive species of water hyacinth. Although in recent years, agencies from government agencies and the private sector have collected water hyacinth, but these measures not only did not help to improve the situation, but the fragmented plant began to move on the surface of the water and in addition to the wetland, it has also polluted the port. The rapid growth of this native Amazon plant and the 20 to 30 years of its rhizome in the environment has caused Anzali International Wetland and most of the water areas of the province to deal with this ominous phenomenon.

The Challenge: Collect, remove and prevent the growth and spread of water hyacinth in Anzali Wetland

Energy, Water & Environment

EW E 13



Islamic Network on Science
and Technology Parks

Subject: Recycling and Burying Waste in Saravan Site and Eliminating Unpleasant Odors

Today, recycling and landfilling municipal waste is one of the significant environmental problems and challenges. Landfills are so widespread these days that litter, odors, and leachate have polluted water, soil, and the environment. In recent years, the problem has become more widespread in many areas, including Gilan province, which faces a population density and lack of suitable spaces for landfilling.

As today the Saravan region of Rasht with towering trees as one of the natural and unique beauties has become one of the landfills and a severe challenge in this province; A mountain of garbage with a height of more than 80 meters with an unpleasant odor and waste leachates that have entered the surface waters and streams, and has also been intensified by rainfall.

The Challenge: Recycling of waste and reducing the inflow of garbage to the Saravan site, preventing the release of unpleasant odors, preventing the production of leachate, or preventing the entry of leachate into surface waters

EW E 14



Universal Scientific Education
and Research Network

Subject: Green Chemistry; Applications and new opportunities in agriculture

Despite the vital role of chemistry in human life, one should not be unaware of the many dangers that threaten human health and the environment from chemical products and processes. Fertilizers and agricultural chemical pesticides, industrial and semi-industrial drugs, plastic materials, gasoline, and other fuels, all kinds of polymer materials, health-cosmetic materials, all kinds of detergents, and all kinds of chemical additives in various industries are all part of chemicals. They are valuable products produced during chemical processes and often harm the environment and human health.

According to the IUPAC definition, green chemistry or sustainable chemistry is the design of chemical products and processes that minimize or eliminate the use or generation of substances hazardous to humans, animals, plants, and the environment. It discusses the engineering concept of pollution prevention and zero waste both at laboratory and industrial scales. It encourages the use of economical and Eco compatible techniques that not only improve the yield but also bring down the cost of disposal of wastes at the end of a chemical process.

Scientists in this field are seeking to replace the current processes with healthier chemical processes, and modeling of biochemistry methods is a suggested way of working because biochemical reactions have occurred over millions of years and have not caused worrying challenges for humans and the environment. Many of these reactions occur in natural conditions and do not require high temperature and pressure. Their products are also easily recycled, and their side products are useful for livestock farmers. Modeling these reactions can reduce current health and environmental challenges.

Dealing with chemical pesticides, waste management, and improving soil quality are the areas of interest in Iran. It requires redesigning chemical reactions and benefiting from the opportunities that green chemistry has at the disposal of the activists in the agricultural field at different stages of this industry, from seed production to harvesting the products.

The Challenge: application of green chemistry, biochemistry, and biological modeling methods in different stages of agricultural fields such as fertilizers and pesticide production, bioremediation, waste and wastewater treatment, pest control, and soil maintenance.

Energy, Water & Environment

WE 15



Sharif Energy, Water and
Environment Institute

Subject: Design and implementation of approaches to improve the social impact of knowledge-based activities for national issues and problems

Establishing and operating universities and research centers involve huge investments from country resources. In turn, they are expected to be heavily involved in fulfilling various social and technical needs and addressing priorities faced by local and national organizations and industries. To this end, internal mechanisms and national policies must be set up to provide the necessary impetus. Key performance indicators should be devised at the Ministry levels, and evaluation criteria should be implemented by the overall objectives. Faculty research grants and students' assistantships, as well as laboratory instruments, should be appropriated in line with the above purposes. These activities would provide incentives for private investments toward product development research projects. Appropriate policies and guidelines are also needed at the legislative levels to provide an integrated framework for education, research, and technology undertakings and activities. Planning and implementation of these processes and procedures should be studied carefully and objectively to ensure dynamic growth and competitive capacity development.

WE 16



Sharif Energy, Water and
Environment Institute

Subject: Novel technologies for monitoring various industrial process parameters

In order to improve operational plans and roadmaps, it is necessary to assess the existing situation using the appropriate indicators. Due to rapid technological development in recent decades, developing countries lack the necessary resources to import such instruments and systems to sustain their operations and maintenance costs. Establishing prototype building facilities paves the way for moving towards self-reliance in various technologies. A priority list should be determined based on field data and feedback provided by the government and private sectors. Novel approaches are welcomed to determine optimized processes and procedures for promoting technology development culture and ecosystem in developing countries.

WE 17



Sharif Energy, Water and
Environment Institute

Subject: Utilization of modern information and communication technologies for generation, processing, and dissemination of information through integrated decision support systems

Management of natural and human resources of a country requires reliable and up-to-date field data in various sectors at different levels. The data collection phase needs to be complemented with careful processing and presentation for efficient and effective decision-making. The design and implementation of integrated information management systems is a key component of quality and quantity assessment. In this regard, novel information and communication technologies are welcomed for the process and dissemination of a wide range of data in various forms.

Energy, Water & Environment

WE 18



Sharif Energy, Water and
Environment Institute

Subject: Devising risk-prone private investments for the commercialization of knowledge-based activities and products

Political realities of developing countries have traditionally been dominated by international pressures from industrially developed policies and national interests through the establishment of non-democratic powerful central governments. As such, no competitive economic infrastructure exists, and private companies do not have the necessary incentives to get involved in risk-prone activities. In this environment, universities and research centers conduct routine activities with little room for innovative approaches and applied research leading to product and/or system development. The design and implementation of policies and processes needed to move from the status quo to a vibrant environment in the chain of knowledge to wealth requires careful studies with the objective of smooth transition with minimal disruptive actions resulting from resistance to change at various levels.

WE 19



Sharif Energy, Water and
Environment Institute

Subject: Clean technologies to reduce environmental pollution

The increasing need for clean air, usable water, fertile soil, and energy has elevated competition for the utilization of natural resources. Considering the increasing environmental challenges due to the use of natural resources to ensure food, health and even social security, taking basic steps to develop clean technologies with the aim of reducing environmental pollution is necessary. These measures can further become a competitive advantage and diplomatic leverage in geopolitical disputes and transnational economic competitions.

WE 20



Sharif Energy, Water and
Environment Institute

Subject: Measurement and monitoring technologies of water, air and soil resources, and energy consumption

The continuous monitoring of water, air and soil resources and energy consumption along with the analysis of the resulting data will provide the necessary information for managing, predicting and evaluating the quality of these resources during different periods, as well as their long-term trend. Therefore, the development of accurate instruments for the measurement and monitoring of resources will help in creating a valuable database of these resources.

Energy, Water & Environment

WE 21



Pakistan National Science &
Technology Park

Subject: Biosynthesis of 3rd Generation Mycofuel

Mycofuel Biosynthesis is the butanol production that can be utilized as one of the best alternatives to conventional fuel. Mycofuel is produced by utilizing agricultural waste for triglycerides synthesis, followed by their transesterification via fungal lipases to yield biobutanol.

The Challenge: Fuel depletion is the main challenge that needs to be compensated by Mycofuel

WE 22



Pakistan National Science &
Technology Park

Subject: Solar Panel Cleaning Robot

Pakistan has recently invested a lot in installment of solar panels and according to data, we have 25,000 industrial units with more than 1.5 GW system and 20,000 commercial units. Accumulation of dust on the surface of the panels of solar voltaic (PV) system is natural. The accumulated dust on the surface of PV solar panels can reduce the output efficiency by up to 40%. The main environmental factors that affect the efficiency of panels are dust, bird dropping, snow, and much more. That being said, the number of units that a consumer is losing (for example for a 10kW solar system) will be 500 units per month.

The Challenge: A solar panel cleaning robot that helps in improving the output efficiency by up to 12%, which is to save 150 to 175 units per month for 10kW solar units.

WE 23



Pakistan National Science &
Technology Park

Subject: Air quality monitoring and purification system

With the average person spending 87% of their time indoors, whether this is at work or at home, Indoor air quality is important but is often overlooked by most people unless something in their home or office is making them sick. Common sources of poor indoor air quality include insufficiently maintained HVAC systems, wood and coal stoves, non-vented gas heaters, environmental tobacco smoke, and vehicle exhaust emissions.

The Challenge: Accurate indoor air quality monitoring alerts residents and building owners to the level and nature of pollution, enabling corrective action.

Energy, Water & Environment

WE 24



Pakistan National Science &
Technology Park

Subject: AI-powered smart energy monitoring system

Smart energy monitoring system offers low-cost, non-invasive / invasive, indigenous designed plug and plays IoT-based three-phase smart AC energy meters. Smart AC Energy Meter captures essential parameters of AC Power and transmits wirelessly to the central cloud. The wireless protocol can be customized as per customer usability. The business domain also provides services of real-time dashboards and data analytics using advanced AI algorithms to effectively utilize energy resources.

The Challenge: An AI-powered smart energy monitoring system which is not limited to energy companies but targets the industrial sector, which requires periodic energy audits and energy management solutions.

WE 25



Mazandaran Science &
Technology Park

Subject: Energy, Water, Environment, Industrial & Hospital Refineries

Due to the climate of Mazandaran and the importance of preserving the environment and underground water resources, the existence of numerous industrial towns, industrial effluents flowing into rivers, etc., which will cause environmental pollution and the source of all kinds of diseases, there are many challenges in the environment.

WE 26



Semnan Science &
Technology Park

Subject: Energy Loss and How to Manage Energy Consumption

Due to the stagnation of the market and the lack of direct access of the artisans to the sales network, the possibility of increasing the income for the industrial owners is very limited. On the other hand, due to the market recession, it is not possible to increase prices. Therefore, for the industrial unit to survive during such circumstances, it is necessary to reduce production costs. One of the main actions is the implementation of the energy management system. A system that includes the technical and managerial aspects of energy management for an organization simultaneously and outlines the necessary methods to control and monitor the output of the system. In this system, it is possible to calculate the type and amount of energy consumption, losses, and resulting costs and make operational decisions regarding energy-saving solutions.

Energy, Water & Environment

WE 27



Semnan Science &
Technology Park

Subject: Power Cut for Industries During Peak Consumption

At the time of a power outage, the industry sector is in the first line of outages and restrictions. This problem has arisen due to the higher demand compared to the power supply in the country, and if it is not resolved immediately, it will be repeated with greater extent and intensity in the coming years. This blackout with the interruption it creates in the production line is harmful to the factory in several ways. Preventing factory power outages by renewable energy through building a rooftop solar or wind power plant is one of the methods that needs further investigation by industrial owners.

WE 28



Semnan Science &
Technology Park

Subject: Municipal Wastewater Treatment

Due to the lack of available drinking water, there is an urgent need to treat urban wastewater and reuse treated wastewater in agriculture and industry.

WE 29



World Federation of Scientists

Subject: Eco-Friendly Cement

Cement is a crucial mineral that has become an essential element in constructing houses, roads, highways, embankments, etc., during the last century. This industry has undergone many changes during different periods and has been able to produce quality products. However, production of one ton of cement can emit up to 1,000 pounds of carbon dioxide. Due to the many applications of this critical industrial material, it has become the third-largest emitter of carbon monoxide in the world. In this situation, it is necessary to produce newer products using new technologies such as nanotechnology and producing fewer greenhouse gases. As an example of such innovations in the cement industry, we can mention nanocomposites in which less cement is used, but they show more resistance than ordinary cement compounds.

The Challenge: New methods for producing cement with better mechanical and chemical properties and creating fewer greenhouse gases in their production process.

Energy, Water & Environment

WE 30



Subject: Renewable Energy for Electrification and Climate Change in India

Coal based power plants constituted the majority of the power generated in India which almost doubled from 148 Gigawatt to 288 Gigawatt during 2008–2015. They majorly contributed to SO_2 (49%), NO_x (34%), PM_{fine} (6.6%) & CO (6%) emissions in India. $\text{PM}_{2.5}$ concentration from power plants was observed to be highest in winter ($14.12 \mu\text{g}/\text{m}^3$) and lowest in monsoon ($1.99 \mu\text{g}/\text{m}^3$). SIA such as SO_4 (47%–100%) and NO_3 (9%–49%) formed the bulk of $\text{PM}_{2.5}$ emitted from power plants. Pollution through these power plants cause an average of 115,000 premature deaths per year and financial loss of about \$4.6 billion.

World Federation of Scientists

WE 31



INN

Subject: Removal of heavy metals from the country's industrial waste waters by ceramic absorbents

Industrial waste waters, contain metal cations, which are very dangerous for the life and health of living organisms and always have a destructive and irreparable effect on the environment. Heavy metals mean lead, mercury, zinc, nickel, chromium, cadmium and so on. The presence of heavy metals in water sources in a concentration higher than the standard value, causes very dangerous complications.

There are various techniques to reduce the concentration of heavy metals, which can be mentioned chemical co-precipitation, reverse osmosis phenomenon, evaporation, ion exchange and absorption. Using the absorption technique is one of the effective and practical techniques. The development of new products that are effective absorbent, have the least harmful effect on the environment, are inexpensive, and can be used to remove and reduce the concentration of heavy metals in industrial waste waters is one of the most important topics in materials science and engineering. The purpose of expressing this challenge is to use ceramic absorbents as an absorbent material to remove heavy metals from industrial wastewater.

WE 32



INN

Subject: Gaseous pollutants elimination from industry exodus using ceramic micro/nanocomposite adsorbents

The ever-increasing need of the world, and especially the developing countries, for industrial products has been very rapid in recent years. It is clear that in line with the increase in industrial production, the consumption of fossil fuels, especially oil and gas, which are the most important suppliers of fuel needs, has increased. In this way, the industries of the country will be the biggest consumers of heavy fuels. One of the problems related to fossil fuel consuming industries today is the presence of NO_x , SO_x , carbon dioxide, carbon monoxide and methane gas, the effects of which are already evident in the country in terms of the emission and creation of many pollutions. The spread of these pollutants and their effects on human health and the environment have been discussed a lot. The release of mentioned pollutants in the country's industries has existed for many years and today it has become much more dangerous than before. The present challenge will be conducted in the direction of study, review and research on the removal of pollutants caused by fossil fuels in the country's industries. In this challenge, these pollutants are divided into four main categories, which include unsaturated and active nitrogen oxides, sulfur oxides and acid condensate, various carbon oxides and methane gas.

Energy, Water & Environment

WE 33



INN

Subject: Absorption of amino acid from the wastewater of dairy factories using ceramic adsorbents

Amino acid is a widely used substance in industry and agriculture, and in most cases, the amino acid needed by the country is supplied through imports. Dairy and starch industries, which use water in all their production processes and have a high discharge of industrial wastewater, are a rich source of amino acids. The upcoming challenge is to absorb the amino acids in the waste water of these factories with by ceramic adsorbents. Using this adsorbent, it can be easily extracted amino acid for different applications. The main purpose of this adsorbent is amino acid absorption, so it can be used in slaughterhouses, dairy factories and other industries. Also, the obtained product can be used as fertilizer in agriculture. It can also be used as a supplement in feeding livestock and poultry.

WE 34



INN

Subject: Affordable energy from renewable sources

One of the most important challenges is energy supply, especially deprived and rural areas. Since access to the energy distribution grid is difficult or impossible in these regions, the approach of providing energy in the form of on-site production based on the climatic/regional potential will be the most likely solution. The main sources of energy in this approach are sun, wind, water and different forms of bioenergy. The important point for these types of energy is its cost, so that they can not only be competitive with fossil types, but can also be used in deprived areas.

WE 35



INN

Subject: Drinking water

According to the climate of the region, access to drinking water is the most important challenge. Not only water resources are limited, but the supply of potable water from these limited sources also faces major difficulties. Therefore, providing economic solutions for drinking water supply based on the climatic potentials is one of the most important goals of applied research.

WE 36



INN

Subject: Plastic recycling

Plastic recycling specially PET and converting to granules for reuse is one of the environmental challenges. In this challenge, the preparation of colorless granules from colored plastics is considered for recycling with higher added value.

Energy, Water & Environment

WE 37



INN

Subject: Cold chain

Storing, preserving, and transporting food and medicine in hot areas without access to the energy distribution grid is one of the challenges that is directly related to the health and living conditions. In the second stage of importance, providing comfortable environmental conditions for living in the hot climate of the region by using climatic potentials and local resources is included in this category. In general, providing sustainable cooling, especially in remote areas in hot climates, is one of the challenges of the countries in the region.

WE 38

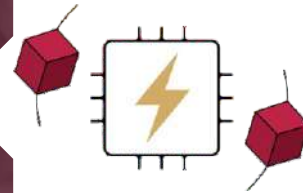


INN

Subject: Solution for industrial wastewater reuse in steel industries

The flocculant material is a polymer poly-electrolyte that is used for rapid precipitation of suspended particles in steel waste. Solutions for local production of this product or similar products for use in the wastewater treatment of the steel industry or other industries are considered in this challenge.

Electronics & Robotics



E&R 1



Pakistan National Science &
Technology Park

Subject: FMCW Radar for Commercial Applications

Radar systems have evolved to find diverse applications in our everyday life. They are an integral part of driverless cars, weather monitoring systems, etc. They are also finding applications in healthcare, sports, and many other fields. FMCW radar is one such system having applications in all these diverse fields. Currently, there are limited manufacturers of such radars and their off-the-shelf use is also limited due to their complex design.

The Challenge: A cost-effective, simple, robust and ready-to-use FMCW radar module is required which can be a tool in teaching as well as for the development of innovative applications using the module.

E&R 2



Pakistan National Science &
Technology Park

Subject: Organic Solar Cells for Powering Microscale Electronics and Sensor Devices; Development of reliable Organic Solar Cells.

Exploration of the development of flexible thin-film micro-scale perovskite organic solar cells (OSC) as an alternate solar cell niche that can enable powering of electronic devices is required. The miniature solar panels could power myriad personal devices including electronic gadgets (smartwatches/tablets/laptops), point-of-care wearable-medical sensors, even low-cost indoor light-energy harvesting-system, and prospective IoT devices.

The Challenge: Development of reliable Organic Solar Cells.

Electronics & Robotics

E&R 3



Universiti Pendidikan
Sultan Idris

Subject: Keys to attract students to STEM Programs

Robotics is one of the pillars of Industrial Revolution 4.0 (IR 4.0). Through continuous research and development (R&D), robots have been transformed from conventional machines of connected mechanical parts, electronics, and electrical components to intelligent machines that are capable of making their own decision. According to the Ministry of Science, Technology and Innovation (MOSTI), Malaysia has targeted a total ratio of 195 robots compared to 10,000 human workforces by 2030 which undeniably requires a huge effort from all related parties. Designing, prototyping, handling and fabricating intelligent robots requires in-depth knowledge of integrated science, technology, engineering and mathematics (STEM). To ensure Malaysia is on pace with other countries in IR 4.0 technology development, a sufficient number of advanced robotic experts are urgently needed. One of the ways is to ensure that sufficient enrolment of students to STEM related programs is guaranteed. However, apart from the trend of decreasing interest in STEM programs, we are now facing a new dilemma because more than 70% of secondary school graduates show no interest to further their studies to a higher level of education.

The Challenge: Robotics is an example of a system that requires the integration of STEM knowledge. However, many students view this knowledge as complex and difficult to learn which eradicates their interest in STEM related programs. How in short term and long term we can ensure that we have sufficient experts in robotics fields? How do attract students to these fields?

E&R 4



Universal Scientific Education
and Research Network

Subject: Wireless power transfer to charge electric cars

Nowadays, considering the non-renewability, cost increase and polluting potential of fossil fuels, consumption of renewable energy resources has attracted great attention in diverse areas. Among them, the transportation sector is responsible for 25% of global energy consumption as well as 15% of greenhouse gas emissions. As a result, investment in the development of electric vehicles has experienced a dramatic increase in recent years.

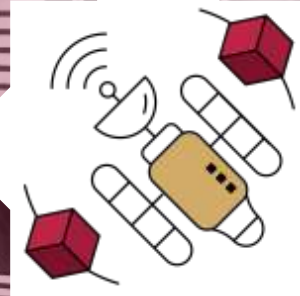
Electric cars, either hybrid or battery-equipped, have been contributing to the reduction in consumption of non-renewable energy resources, although their contribution is not as sufficient as expected. Facilitating charging methods of such vehicles can be a proper way to encourage consumers to use them. Electrical energy transfer methods in a wireless manner can be employed to charge these cars, in static or dynamic conditions, i.e. in cases of being parked or in motion.

The Challenge: Proposing practical methods to transfer energy, introduction of corresponding wireless transmitters and receivers as well as designing appropriate infrastructures in order to facilitate the use of electric cars.

ICT & Artificial Intelligence

INFORMATION
AND TELECOMMUNICATION
TECHNOLOGY

ICT



ICT-AI 1



Pakistan National Science &
Technology Park

Subject: Online Identity Verification

In order to authenticate the ID document whether original or fake/copy, the security features in the ID document need to be detected and then verified. AI/ML techniques can be used to detect these security features; however, they need a large dataset. Unfortunately, due to privacy concerns, for all practical purposes, it is difficult to obtain a large dataset for ID documents.

The Challenge: Online identity verification poses a number of challenges including Liveness Detection - checking whether the person is live or someone is showing a video/picture, Document Authenticity- checking whether the document is originally based on the security features and Document Ownership - checking whether the document belongs to the person in front of the camera.

ICT-AI 2



Hamrah e Aval

Subject: Expanding educational justice through technology

Educational justice is defined as the provision of learning opportunities for the all-round development of all human beings.

In order to achieve social justice, education should be in such a way that we could identify the talent and ability of students anywhere in the country, value them and provide infrastructure for their flourishing.

From this point of view, educational justice is not only to build schools in urban slums, and rural area, but also to provide services, facilities, and learning opportunities similar to developed cities in order to identify talents and develop capabilities by using technology.

The Challenges:

- What is the best way to use technology for developing countries to expand educational justice considering their infrastructures?
- Poverty leads to lack of access to education. How to use low-cost technology to move towards the improvement of educational justice?
- Could virtual learning pave the path for development of educational justice? Considering the lack of internet access and inability to afford the cost of technology & etc. in education by some students especially in deprived area.

ICT & Artificial Intelligence

ICT-AI 3



Khazar University

Subject: Unsupervised machine learning

Unsupervised machine learning algorithms infer patterns from a dataset without using known or labeled outcomes as a guide. Unsupervised machine learning methods cannot be applied directly to a regression or classification problem because you have no idea what the values for the output data might be, making it impossible to train the algorithm normally. Unsupervised learning, on the other hand, can be used to uncover the underlying structure of the data.

ICT-AI 4



Khazar University

Subject: Explainable AI

The notion refers to the ability to explain an AI model, its expected impact, and potential biases. It contributes to the definition of model accuracy, fairness, transparency, and outcomes in AI-powered decision making. Explainable AI is critical for an organization to build trust and confidence when deploying AI models. As AI advances, humans are challenged to understand and retrace how the algorithm arrived at a result. The entire calculation process is transformed into a 'black box', which is impossible to interpret. These black-box models are built entirely from data. Even the engineers or data scientists who created the algorithm are unable to understand or explain what is going on inside them or how the AI algorithm arrived at a specific result. There are numerous advantages to understanding how an AI-enabled system produced a specific result. Explainability can assist developers in ensuring that the system is performing as expected, it may be required to meet regulatory standards, or it may be necessary to allow those affected by a decision to challenge or change the outcome.

ICT-AI 5



Khazar University

Subject: AI is a multidisciplinary field of research

These days, the world is facing a multidimensional challenge of integrating the concept of AI into our every-day life, making effectively positive sense out of it, and creating a commonly accepted legal framework to 'accommodate' the phenomenon. This challenge is of a complex as well as interdisciplinary nature, and the latter point is usually missed in academic curricula offered on the AI-associated matters. There has to be an effective approach to combine Governance, Advancement, and Legislation to address the aforementioned shortcoming.

ICT & Artificial Intelligence

ICT-AI 6



Universiti Pendidikan
Sultan Idris

Subject: Keys to Promote Artificial Intelligence

Malaysia Higher Education has incorporated knowledge of Artificial Intelligence in many sectors like Computer Science and Engineering to create systems and machine learning which can solve problems in many sectors.

For example, enhancing customer experience, augmenting employees' capabilities, and stimulating a higher value by adding work experience. Underneath the IR 4.0 and MyDigital blueprint in Malaysia, the government intentions to boost productivity by 30% across all sectors by 2030. For Artificial Intelligence to succeed, it must be endorsed by a healthy, purpose-driven, and open-data ecosystem in the education system at its early stages.

The Challenge: Strategies to promote Artificial Intelligence in Malaysia.

ICT-AI 7



Universiti Pendidikan
Sultan Idris

Subject: Assistive Educational Technology for Autism

In Malaysia, the number of children with autism spectrum disorder (ASD) or neurological differences has increased dramatically. According to autism statistics, 1.6 out of 1000 Malaysian children have been identified as on the spectrum, and the figures keep increasing with an established prevailing rate of 1-2% globally. Alongside this, the biggest challenge for individuals with ASD is to be independent and get jobs after schooling. Furthermore, ASD students are facing serious insufficient practice/enhancement materials after school hours and guidebooks for parents/caregivers to enhance their living/vocational skills at home.

The Challenge: In response to the aforesaid gap and to decipher the myriad of potential uses of Artificial Intelligence (AI) as assistive educational technology, how AI can help ASD in learning?

ICT-AI 8



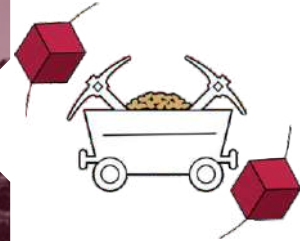
Universiti Pendidikan
Sultan Idris

Subject: Internet and telecommunication network factors

Nowadays, IoT technology is increasingly used in daily life, but in rural areas its use is still not possible due to the internet and telecommunication network factors. Therefore, an effort needs to be made by experts so that communities in the rural areas can also use IoT technology in the future.

The Challenge: What are the suggestions for providing internet of things in rural areas where there is no internet and communication network?

Mining & Mineral Industries



M&M 1



Semnan Science &
Technology Park

Subject: Solving Problems Related to Excavation and Operation

Determining the reserve and accurate grading of minerals, especially in the depths of the earth, requires exploratory drilling machines with the ability to drill in the depths of the earth with very high accuracy, and it will be possible to build such machines with the support of the government.

M&M 2



Zarrin Industrial &
Mining Group

Subject: Reduction of Iron in the Production Process of Nepheline Syenite Concentrate.

The nepheline syenite mineral is processed in a concentrate factory and its iron is reduced.

Iron is considered as a pollutant and reducing its amount leads to an increase in the added value of the final product.

In this way, we have reached operational technologies to reduce the grade of iron and other pollutants. Our challenge is to achieve the executive method in the factory in reducing the grade to 0.05 percentage is technically and economically justified

The Challenge: New operational technology, reduction of iron grade to 0.05%, constant oxide content.

Mining & Mineral Industries

M&M 3



Zarrin Industrial &
Mining Group

Subject: Extraction and separation of rare earth elements from their concentrate with apatite base

Extraction and separation of rare earth elements from their concentrate with apatite base. Concentrate of rare earth elements with apatite concentrate base contains 30% of LREE, HREE and MREE that have gained the knowledge of its technology. Also, we have even reached the separation of Cerium, Lanthanum and Neodymium.

The Challenge: Isolation and extraction of other rare earth elements in concentrate by a method applicable in semi-industrial and industrial scale.

M&M 4



Zarrin Industrial &
Mining Group

Subject: Conversion of calcium sulfate as a by-product to the grade of gypsum as construction materials.

Calcium sulfate is a byproduct of the most with the sulfuric acid chemical processes.

In many cases, this product is turned into a dry cake with high purity in the factory after separation, filtration and washing.

Despite its high purity and gypsum phase conversion, it cannot be used as a construction material.

Therefore, many industries face large volumes of acidic waste depots that have high environmental accumulation costs.

The Challenge: Inventing a method for converting process gypsum to construction gypsum with technical and economic justification on an industrial scale.

M&M 5



Zarrin Industrial &
Mining Group

Subject: Accurate measurement of lithium and bromine in various types of brine, extraction and separation methods on an industrial scale.

The brine contains salts of alkali and alkaline earth metals.

The concentration of calcium, sodium, potassium and magnesium cations is ten thousand times that of lithium.

In the existing measurement methods, we encounter cationic interference for lithium, and on the other hand, it is very difficult to separate this valuable element in low concentrations with the presence of the above cations.

The Challenge: Build a correct measuring device without interference on ppb scale (Except for ICP-OES device of Jena Analytical Company).

Also, an economic method of separation on a semi-industrial scale that has the necessary technical and economic justification.

Mining & Mineral Industries

M&M 6



Zarrin Industrial &
Mining Group

Subject: Enrichment of low - grade hematite ore tailings in plant scal

Access to hematite mines for the production of concentrate above 60% is based on domestic and foreign market demand in previous years in Iran.

In this way, the lack of use of advanced machines and methods has led to the accumulation of numerous depots called tailing.

With increasing market demand and shortage of hematite reserves, hematite accumulation tailing is considered as a secondary source of iron on which many mining operations have been performed.

These sources have a lower grade than concentrate and can be converted to concentrate by acquiring new high-grade technologies.

These resources are economically justified and reduce environmental problems.

The Challenge: Inventing mechanical processing methods with technical and economic justification on a semi-industrial and industrial scale.

M&M 7



Zarrin Industrial &
Mining Group

Subject: Extraction of natural gas from coal seams (CBM).

Methane gas is one of the gases emitted from coal seams that is released from the mine by ventilation and is released into the atmosphere (air). In addition to degrading the environment, the emission of this gas also wastes a vast source of energy. According to research, several billion cubic meters of methane gas is released annually from the world's coal mines. Due to the importance of energy resources, drainage operations are currently underway in many coal mines around the world, and in this regard, methane gas produced in coal seams is collected using special methods and transported out of the mine by pipelines. Becomes. This gas is used to generate electricity, sell and use the mine based on grade and quantity. The main purpose of this method is gas drainage by CBM method and electricity generation.

The Challenge: "Study of effective geological parameters, including:

Layer thickness, Layer depth, Layer uniformity, Expand layer, High waist and waist layer features, The amount of gas concentration, Gas compounds, Permeability status, Coal quality, Feasibility study of Iranian coal mines and implementation of the method according to financial and technical conditions"

M&M 8



Zarrin Industrial &
Mining Group

Subject: Adjustment of silver to residue from melting of oxidized lead and sulfur concentrate in slag of rotary kilns less than 50 ppm

In lead smelters, rotary kilns are used to melt the input feed (concentrate, lead sulfate, battery soil and all soils with acceptable lead grade). In most of these feeds, especially lead concentrate, according to the analyzes taken, we see a significant silver content (between 100 and 2500 ppm). After the feed is melted by rotary kilns, part of the incoming soil in the form of slag and tailings is removed from these kilns.

According to the analyzes taken from these wastes, it has been observed that there is about 80 to 110 ppm of silver in this tailings. Due to the high tonnage that is rotated daily in this factory, it can be concluded that a significant part of this silver will be lost in the tailings of smelting furnaces. The aim of this collection is to provide a suitable, engineered and possible solution to reduce the silver grade in the rotary kiln tailings.

The Challenge: Minimize the consumption of additives Minimize the melting time Prevent oxidation of silver Prevent the use of additives that could damage the refractory furnace Avoid methods that reduce the efficiency of lead extraction Maximum efficiency of silver mining along with economic efficiency

Mining & Mineral Industries

M&M 9



Zarrin Industrial &
Mining Group

Subject: Measurable chemical feeders

In lead smelters, rotary kilns are used to melt the input feed (concentrate, lead sulfate, battery soil and all soils with acceptable lead grade). Depending on their nature, these feeds often contain between 50 and 80 percent lead. According to international standards, the amount of lead in slag from the melting of incoming soil in rotary kilns should not be more than 1.5 to 2%. The purpose of this set is to provide a suitable, engineered and feasible solution to reduce the lead grade in the tailings of the rotary kiln.

The Challenge: Minimizing the consumption of additives, Minimize melting time, Prevent lead oxidation, Prevent the use of additives that could damage the refractory furnace, Avoid methods that reduce the efficiency of lead extraction, Maximum lead extraction efficiency along with economic efficiency, Avoid methods that are inconsistent with the implementation of the first proposal

◆ Message From the Head of KANS 2022

Professor Saeed Sohrabpour

In the third round of the KANS scientific competition, I invite young instructors, university students, and innovators under 45 years of age to participate in this competition by submitting their scientific achievements or solutions for challenges declared by international scientific institutions. I wish more success to Islamic world in scientific cooperation.



◆ About Mustafa^(pbuh) Science and Technology Foundation (MSTF):

Laying emphasis on the development of science and technology in the Islamic World by adopting a nonprofit approach and maintaining full independence in achieving its goals, revering the Holy Prophet^(pbuh) and following Islamic teachings, the Mustafa^(pbuh) Science and Technology Foundation (MSTF) has been established.

MSTF Foundation has started its activities by facilitating collaborations, networking, accreditation and discourse making among the Islamic countries in the field of science and new technologies and forming contiguous chain of knowledge and wealth.

KANS

Let's Do it Together



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