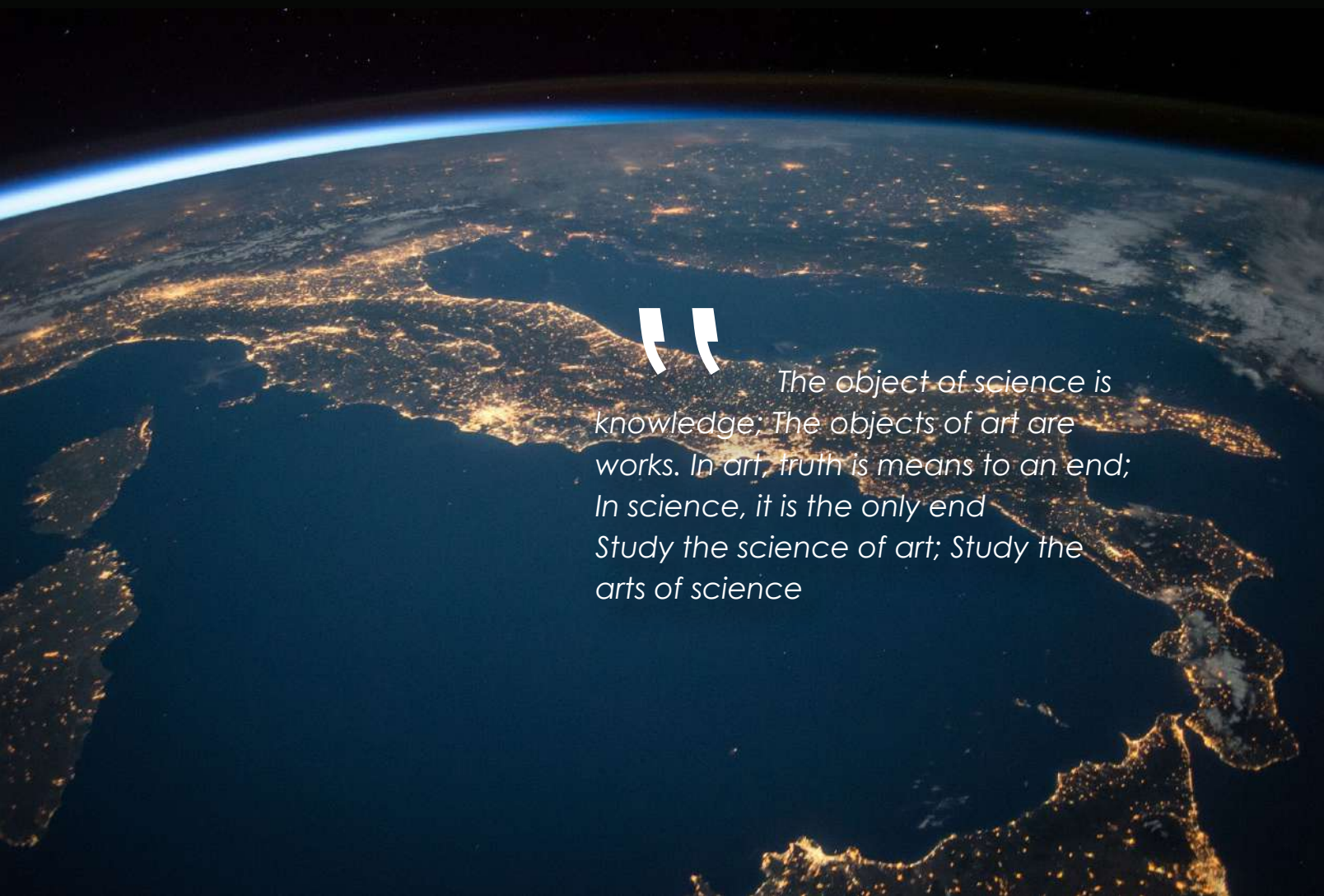
Volume 01

UET SCIENCE MAGAZINE

BROUGHT TO YOU BY UET SCIENCE SOCIETY



"The object of science is knowledge; The objects of art are works. In art, truth is means to an end; In science, it is the only end Study the science of art; Study the arts of science

This Page is left blank intentionally.

UET SCIENCE MAGAZINE

BROUGHT TO YOU BY

UET SCIENCE SOCIETY

CONTRIBUTORS

Editor-in-Chief:

Farukh Ahmad Malik

Editorial Board:

Haseeb Raza
Mirza Ayan
Mudassar Habib

Editors:

Muhammad Noman
Ahmad Arif
Mohsin Ali Asghar
Ammara Liaquat
Arshmah Hasnain

Design Director:

Touseef Akhtar

Assistant Editors:

Fabiha Farooq
Talha Shahid
Usama Navid
M Usman Ali
Ehtisham Asif
Romaisa Arif
Fahad Murtaza
M Usman Malik
Nayab Moazzam
Faiza Ashfaq
Fatima Nadeem
Esha Rasheed
Shehroz Ameer
Talha Saeed
Maham Naveed

Designers:

Ehtisham Asif
Ehmad Saeed

HOLY VERSES FROM QURAN

بسم الله الرحمن الرحيم

In the name of Allâh, the Beneficent, the Merciful.

اقرا باسم ربک الزی خلق ۚ ① خلق الا نسان من علق ۚ ②

اقرا و ربک الاکرم ۚ ③ الزی علم بالقلم ۙ ④

علم الا نسان ما لم یعلم ؕ ⑤

Read in the name of thy Lord Who created ① Created man from a clot, ②

Read and thy Lord is most Generous, ③ Who taught by the pen, ④

Taught man what he knew not. ⑤

ABOUT UET SCIENCE SOCIETY

Uet Science Society is a non-technical society that aims to be the identity of every UETian by bringing together UETians from all departments. We desire to transform our student body into a community of learners that value curiosity and creativity, where conversations that critically analyze scientific and technological breakthroughs become commonplace and where students are driven to explore the depths of their curriculum rather than giving it a cursory glance.

Our organizational ideology is geared towards constantly evolving and reinventing our strategies. We can always do better; make great strides and improvements rather than stagnating. Uet SS is a place where everyone gets an equal opportunity to shine and there is something for everyone.All our efforts are to motivate and inspire UET's student body to learn with passion, and utilize their intellectual talents in the best way possible.

We are the torch bearers of a new era!

MESSAGE FROM OUR ADVISOR

PROF. DR. MUHAMMAD SHAHID RAFIQUE
DEAN OF NATURAL SCIENCES
UNIVERSITY OF ENGINEERING AND TECHNOLOGY, LAHORE

By the grace of Allah Almighty and after a very long struggle, UET Science Magazine has finally made its debut. I would like to thank all the participating students, the editorial board and faculty members for putting their efforts into this magazine.

UET Science Magazine is not just a magazine, but a sincere effort to promote innovation and research in the science and engineering sector of UET. In my opinion, students do have the potential, but unfortunately it is hidden because of lack of opportunities and appreciation. UET Science Magazine aims to unleash that very hidden potential of the young scientists, engineers and researchers by providing them the opportunity to showcase their findings. With UET Science Magazine, the true researchers are sure to get attention once they publish their findings, and it will urge others to do the same. A sense of healthy competition and challenge will develop, resulting into a new culture at our university. I am very hopeful that this step will play an important role to reshape the culture of UET by making it more research-oriented. My best wishes are with UET Science Magazine and its team and I pray that it only grows and becomes the official science and engineering magazine of UET.

This Page is left blank intentionally.

IN THIS **ISSUE**

Volume 01

Legends of Physics

Interesting & Innovative Inventions of this Era

Scientific Blogs

Final Year Projects

Reviews & Articles

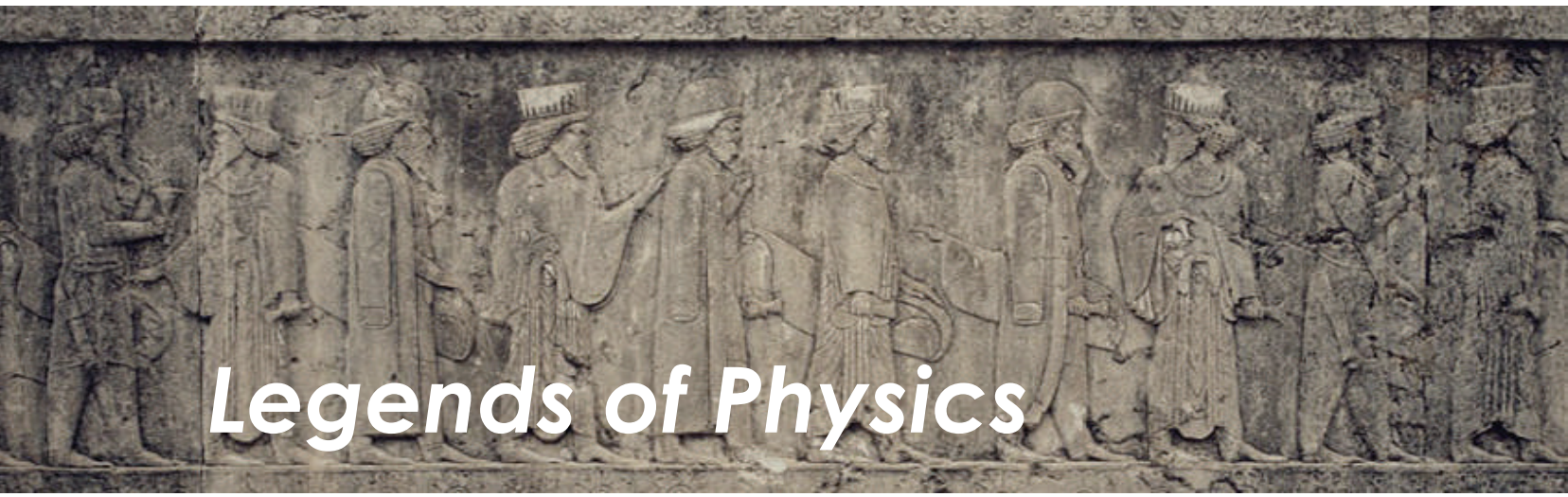
Science Rhymes

IN THIS **ISSUE**

Volume 01

Study Abroad Scholarships

Top Rising Organizations



Legends of Physics

MOHSIN -E- PAKISTAN
(DR. ABDUL QADEER KHAN)

Some people devote their lives for the prosperity of their nations which makes them immortal in the history. They live their lives acting as a torch bearer , an inspiration, and a guide to the people of their motherland. Dr. Abdul Qadeer Khan, a renowned Pakistani Nuclear Physicist and a Metallurgical Engineer is one of those ever shining stars who have illuminated the scientific records of the world with their radiance.

Dr. Abdul Qadeer Khan was born on April 27, 1936 at Bhopal in central India. He got his primary education in Ginnori Primary School and passed his matriculation from Alexandria High School later named Hameedia High School. From Karachi University he completed his B.Sc. degree in Metallurgical Engineering. He then left for Germany for higher studies. He obtained the degree of Master of Science (Technology) in 1967 from Delft University of Technology, Belgium and then earned a doctorate in metallurgy from the Catholic University of Leuven (Belgium) in 1972. His doctoral thesis included fundamental work on martensite and its extended applications to the field of morphology. He excelled as a metallurgist — an expert at building centrifuges — hollow metal

tubes that spin very fast to enrich natural uranium in its rare U – 235 isotopes, which is an excellent bomb fuel.

Dr. Abdul Qadeer Khan is hailed by the masses as a national hero and Father of Pakistan's Nuclear Program. In 1974 after the atomic attacks of India Dr. AQ. Khan wrote a letter to the Prime Minister of Pakistan Zulfiqar Ali Bhutto regarding his job and offered his services for achieving uranium enrichment. He met Bhutto in December 1974 and convinced him to manage nuclear deterrence. He worked with Pakistan atomic energy commission at first but didn't find himself at home there. So, Bhutto gave him autonomous control of Kahuta Research Laboratories.. As a result of the constant struggle of two years of Dr. AQ. Khan with other research laboratories he was able to gain uranium enrichment for Pakistan. On May 28, 1998 Pakistan conducted its atomic bombs and

emerged as the only Muslim state to have uranium enrichment. It was a proud moment for the people of Pakistan. Dr. AQ. Khan emerged as a hero after this huge effort from his side towards his motherland. He said himself.

"No money on earth can buy the love and affection that has been given to me by a grateful nation."

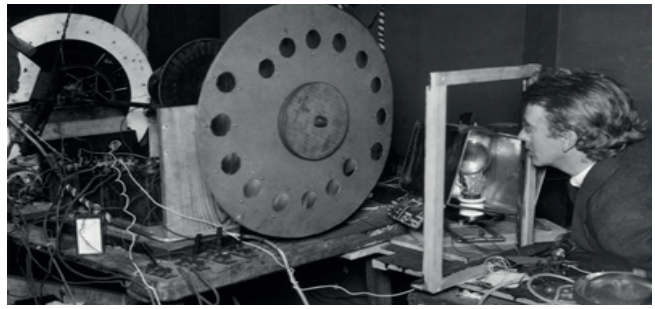
It was the fruit of his profound efforts that Pakistan was able to gain uranium enrichment in order to test the Intermediate Range Ballistic Missiles, Ghauri 1, in April 1998 and Ghauri II in April 1999. Dr. AQ. Khan's role in Pakistan's national space agency, SUPARCO is also worth mentioning. In the late 1990s, Khan played a vital role in Pakistan's space program, particularly the Pakistan's first Polar Satellite Launch Vehicle (PSLV) project and the Satellite Launch Vehicle (SLV)

he contributions of Dr. Abdul Qadeer Khan towards the development in science and technology are truly commendable. As an active physicist and technologist, he has published more than 188 scientific research papers in famous international scientific journals. Dr. AQ. Khan received honorary degrees of Doctor of Science from the University of Karachi in 1993, from Baqai Medical University in 1998, Doctor of Science from Hamdard University, Karachi in1999, and from the University of Engineering and Technology, Lahore in December 2000. For his excellent contributions in the field of science and technology, Dr. AQ. Khan was awarded Nishan-i-Imtiaz in 1996 and again in 1998. Thus, he is the only Pakistani to have received twice the highest civil award.

Dr. Abdul Qadeer Khan has a vital role in establishing several engineering universities in Pakistan. He set up a metallurgy and material science institute in Ghulam Ishaq Khan Institute of Engineering Sciences and Technology. This department is named as Dr. AQ. Khan Department of Metallurgical Engineering and Material Sciences after him. At Karachi University, Dr. AQ. Khan Institute of Biotechnology and Genetic Engineering is another school which has also been named in his honor. In short, he played a vital role in the development of metallurgical courses in Pakistan. He has also founded a trust hospital for the people of Pakistan named as Dr. AQ. Khan Hospital.

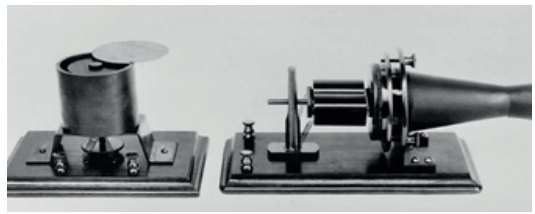
Known as a savior and a hero in true spirits, Dr Abdul Qadeer Khan continues to maintain wide spread popularity not only in Pakistan but also across the globe. Such devoted and selfless personalities are the assets of our country and the nation needs to seek inspiration from them in order to work for the prosperity of their motherland.

JOHN LOGIE BAIRD
(TELEVISION INVENTOR)



John Logie Baird (1888-1946), the Scotsman who was the first person in the world to demonstrate a working television system. On January 26th, 1926, a viable television system was demonstrated using a mechanical picture, scanning the electronic amplification at the transmitter and at the receiver. It could be sent by radio or over ordinary telephone lines, leading to historic trans-Atlantic transmissions of television from London to New York on February 1928.

ALEXANDER GRAHAM BELL
(TELEPHONE INVENTOR)

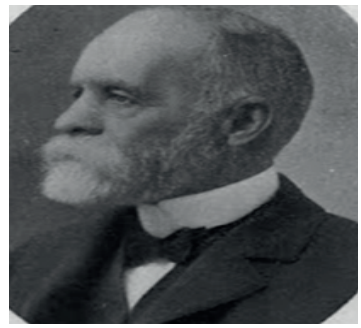


Both Bell's mother and wife were deaf, a fact that greatly influenced his life's work. It was his focus on speech, hearing and amplification that led Bell to his invention of the telephone. Bell started by experimenting with tuning forks, making vowel sounds by mechanical means. From there, he sought to develop a method of creating consonant sounds by those same mechanical means. Bell became fascinated with a method that would translate the human voice into vibrations, vibrations that could be read and transmitted by a machine like a telephone.

HUBERT CECIL BOOTH
(VACCUM CLEANER INVENTOR)

The first vacuum cleaner was invented by Hubert Cecil Booth of England in 1901. Booth was inspired by a demonstration of Thurman's machine at the Empire Music Hall in London so much that he tried the idea that he had almost immediately. He placed a handkerchief on the seat of a restaurant chair, put his mouth to the handkerchief and sucked the air in. When he saw how much of the dust gathered on the handkerchief, he knew that his idea has merit. His vacuum cleaner had an internal combustion engine which powered a piston pump which pulled the air through a cloth filter. The whole machine was pulled by a horse, and people called it "Puffing Billy." It was big, and it could not enter buildings and only its tubes were inserted through the windows. His next model was powered by electricity but was also too big and not suitable for individual homeowners so it was used as a cleaning service or it was installed in the building itself.

HENRY W. SEELEY
(ELECTRONIC IRON INVENTOR)



Seeley patented his “electric flatiron” on June 6, 1882. His iron weighed almost 15 pounds and took a long time to warm up. A clothing iron also called a flatiron, is a small appliance: a handheld piece of equipment with a flat, roughly triangular surface that, when heated, is used to press clothes to remove creases. It is named for the metal of which the device is commonly made, and the use of it is generally called ironing. Ironing works by loosening the ties between the long chains of molecules that exist in polymer fiber materials. With the heat and the weight of the ironing plate, the fibers are stretched and the fabric maintains its new shape when cool.

Interesting & Innovative Inventions of this Era

VECTOR

Actually, Vector's more than a home robot. He's your buddy. Your companion. Most of all, he'll make you laugh. Curious, independent, and powered by some preposterous tech and AI, he can read the room, express the weather, announce when his timer's done (no overcooked dinner on his watch), take the perfect snapshot, and so much more.
Vector is your robot sidekick who's up for anything. He's the robot to live with.
A helpful character.
Vector is happiest when he's helping. He's eager to accommodate your requests and answer your questions.
He does it with built-in utility and an optional integration with Amazon Alexa. This integration gives Vector the home connecting power of Alexa plus the endless amount of skills constantly being developed.
He isn't a fully grown robot butler capable of doing your taxes, buttering your bread, or writing a position paper on the future of robot/human relationships, but he's a helpful little guy who puts his whole self into helping you out.

Inventor Name: Andrew Stein

ORASAIFU

Introducing Orasaifu created by Ora Inc., the first of its kind hardware smart wallet. It is one solution for your asset storage, transaction, and recovery.
No more problems from the obsolete wallets, the OraSaifu permits you securely store all your Credit Cards, Debit Cards, alongside gift vouchers, tickets, work identifications or even your rec center participation cards across the board place, and everything is sorted out and open readily available.
It can manage all your cryptos, by offering easy and worry-free offline storage, and 2 step authentication transaction. It uses one card with two modes that allow both crypto and banking functions to exist in the same hardware.
One most fascinating feature that sets this product aside from the other ones in the market is that it relies on both a Trusted Execution Environment (TEE) and in the SE technology using only a single chip for this. By using this kind of technology, the users are considerably safer when using the hardware.
It also has support for other 20 altcoins. You can use it to send payments, receive them and check your account details for multiple accounts.
The service always requires two-step authentication for transactions and a USB port, which always leaves your private keys isolated from the internet.
In order to prevent the device from hackers, designers make sure that any computer cannot have access to them.
It supports many types of cards, even business cards, and membership ones. This way, you do not need to have a lot of cards just to open doors for your gym or office.

INSTADREAMER

The InstaDreamer bracelet will propel you into a world where you can control your dreams, making absolutely anything possible. InstaDreamer is the first to use Pavlovian conditioning via subtle vibrations to train your brain to recognize when you're dreaming in order to achieve vivid, lucid dreams.

How does it work in a nutshell?

- Day mode: It vibrates during the day (you decide how often), reminding you to perform a reality check (using the power of Pavlovian Conditioning proven scientific theory). Since you're not in a dream, nothing happens.
- Night mode: It accurately detects your REM phases during the night, vibrating at the best moment of your dream (you decide how strongly) to instantly trigger a lucid dream by activating the conditioning. Since you are in a dream, you will realize that you are dreaming and be able to take full control instantly, allowing you to experience whatever you want to.
- Unlike other lucid dreaming solutions, InstaDreamer is a comfortable and discrete band that you can wear with anything. InstaDreamer won't disrupt your sleep like eye masks, electrode stickers, or light and sound that other products use.
- With InstaDreamer, we want you to have a restful slumber all while conditioning yourself to have the wildest dreams imaginable. Our VibraSmart™ technology sends subtle vibrations to your band that allows you to check if you are

dreaming or not. It also tracks your body's vitals to help learn the best time to wake you, so you always wake up feeling refreshed.

- The InstaDreamer is not connected during the night. You don't need to have any Bluetooth/WiFi on: It is a 100% standalone device (offline) and will upload the data to your phone as soon as it detects a network that your phone can access (your phone will automatically share the WiFi credentials with the bracelet).

ZUUM HOVER SHOES

If you're thinking that this sounds like an embarrassing fall waiting to happen, then ZUUM's self-balancing gyroscope built into each 'shoe' should put your mind at ease. In fact, according to Guerra, a complete newbie should only need an hour to accustom themselves to using the device.

DRAVERIK WATCH 2

The watch created exclusively to view your documents. A wireless pen and a touch panel enable you to browse through your documents in a fast and discreet manner. A universal, classic design with over 54 combinations will let you create a perfect watch just for you.`

SHOR'S ALGORITHM
A THREAT TO INTERNET PRIVACY

It's the year 2040 and you check the news to see that hundreds of people are being arrested because an extremely efficient computer broke the standard encryption method that they had used to share their dark secrets. Government secrets have been exposed and those old politicians are now being sent behind the bars. Doesn't seem likely, right?

In 1994, mathematician Peter Shor developed a theoretical algorithm that could find the prime factors for any composite number. His algorithm worked on a device i.e. a quantum computer, that was a far-fetched reality at that time and most of the researchers showed little to no interest since there was nothing a quantum computer could do that a classical computer was incapable of. Peter Shor sparked the interest of researchers around the world who began their own research into quantum computing and now actual, working quantum computers are being built. Now before we get started on how this works, let's first discuss these terms briefly.

- **RSA encryption**

RSA encryption is the standard cryptographic algorithm on the internet. It is an asymmetric cryptography algorithm which means it works on two different keys i.e. Public Key and Private Key. As the name describes, the Public Key is given to everyone and the Private key is kept private. RSA encryption is based on a simple

idea: prime factorization. RSA encryption is usually qualified with a bit length, such as 128-bit, 256-bit, etc., which represents the bit length of the key used to encrypt and decrypt data.

- **Quantum Computers**

A quantum computer is any device for computation that makes direct use of distinctively quantum mechanical phenomena, such as superposition and entanglement, to perform operations on data.

- **Shor's Algorithm**

Shor's algorithm is a quantum computer algorithm for integer factorization. Informally, it solves the following problem: Given an integer N, find its prime factors.

How does it work?

Shor's Algorithm is a three-part answer to the problem of prime factorization for any integer, so it works no matter how large the integer involved is. The first part is performed on a classical computer in polynomial time, but it is only the set-up for the second and most important part. The second part requires the use of specially constructed quantum circuits to perform quantum computation needed to find the value you need for the third part, which allows you to find the prime factors of the integer on a classical computer. Using this algorithm and a quantum computer, RSA encryption can be broken exponentially faster than the best-known classical algorithm.

Should we be concerned?

Quantum computers are getting better every day. Advances in novel materials and in low-temperature physics have led to many breakthroughs in the quantum computing field in recent years. and large commercial quantum computer systems will soon be viable and available within five years. In 2012, physicists used a four-qubit quantum computer to factor 143. Then in 2014, they used a similar device to factor 56,153. At this rate, we can expect quantum computers to outperform classical in a matter of a few years but it isn't as easy as it sounds.

It turns out that quantum factoring is much harder in practice than might otherwise be expected. The reason is that noise becomes a significant problem for large quantum computers. And the best way currently to tackle noise is to use error-correcting codes that require significant extra qubits themselves. Researchers have shown how a quantum computer could break RSA-2048 encryption with just 20 million qubits. Such a device would take just eight hours to complete the calculation. The most advanced quantum computer has a 72-qubit processor and is still being tested by Google.

Researchers have already developed encryption algorithms that are said to be quantum-proof. One of them is Lattice cryptography, which mathematically has been proven to be resistant to quantum computing attacks. So far, no known algorithms can break this method of encoding data.
In a not so distant future, RSA encryption will be easy to break but hopefully, most of the internet by that time would've moved to a better and more secure form of encryption. You shouldn't be really worried about it unless you've shared a national secret over the internet assuming that your RSA encryption will save you.

MACHINE LEARNING

Machine learning is an application of Artificial Intelligence (AI) allowing machines to develop the ability to learn and improve from experiences, data, pattern identification, and to make decisions with minimal human intervention. Machine learning focuses on the development of computer programs that can access data and use it to learn for themselves. Once completely mastered, machine learning will revolutionize the industries and programming itself.

Machine learning is not a new concept – but it is one that has gained fresh momentum. Scientists have always been making efforts to make machines smarter by programming them to learn from pattern recognition and data. Many algorithms for this purpose have been around for a while, however, the capability to solve complex mathematical problems with huge amounts of data over and over again is a new development. Through progress in the field of machine learning, companies like Google and Tesla have been able to develop self-driving cars. Furthermore, this field has paved its way to online surfing as well. The algorithms of browsers recognize the pattern of our searching habits and then offer advertisements based on those patterns. The recommendation offers from Amazon and Netflix are a perfect example of machine learning.

Machine learning is no doubt a very significant application of artificial intelligence enabling multitudes of computational programming at low costs, with more power and affordable data size. All of this is possible because of the machine's learning abilities from the data provided to it just as a human being learns from experimental data. Another important daily life application of machine learning is virtual personal assistants like Siri, Alexa, Google Now, Cortana. You can get good use out of these personal assistants as they can help is setting your schedule, alarm clock and can answer your questions by searching from the resources that are allocated to it. Traffic predictions are another useful fruit borne as a result of machine learning. Almost everyone uses GPS navigation system these days. These systems store our current locations and velocities at a central server for traffic management. This allows the machine learning algorithm to build a road map showing the current traffic. This aids people who are in a hurry to avoid roads with high traffic and take an alternate route if possible.

Machine learning has significantly reduced the probability to catch viruses through email spam. Over 325,000 malware are detected every day and their code is 90-98% similar to the previous versions. The security programs that are powered by machine learning recognize the pattern and detect these pieces of malware, thus offering protection to the recipients of such emails. Machine learning also protects us from online fraud and is progressing to make cyberspace a secure place. For instance, PayPal uses machine learning to prevent money laundering. The company uses a learning algorithm to detect transactions taking between buyers and sellers, and distinguish between legitimate or illegitimate transactions. Google and other search engines use machine learning to improve the search results for us. The algorithm will detect how you respond to search results, whether you select the top results and open links containing to the first page or move on to the second page and open links from there. In this way, by analyzing your research pattern, the algorithm improves itself every day to show results pertaining to your needs and interests.

Machine learning is finding more room day by day in our daily activities. Researchers are striving to study this subject deeper to develop more advanced and powerful algorithms that can analyze larger amounts of data and give fast results. No doubt, the field of Artificial intelligence (AI) and machine learning are one of the biggest breakthroughs in the world of science and technology and they continue to amaze us with their potential.

NEURALINK BRAIN IMPLANT

Although the invocations in artificial intelligence and technology have stated converting sci-fi things into the reality since a long time ago but it was not until mid July 2019 when Elon Musk publicly announce secretive startup named Neuralink which is aimed to achieve a symbiosis between the human brain and the computer. Startup Neuralink found in 2016 was publicly reported for the first time in March 2017 but now it has disclosed that it is going to have the first test on human before the end of 2022 using the neuro-surgery robot capable implanting thread with micron precision using a needle of diameter 24 microns.

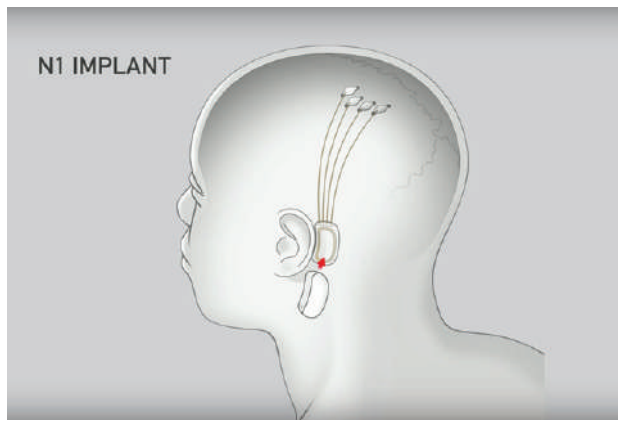


Figure 1: Neuralink N1 aims to connect the human brain to machines

Brain's neural network is a population of neurons interconnected by synapses to carry out a specific function when activated. The brain's neurons connect to form a large network through synapses. At these connection points, neurons communicate with each other using chemical signals called neurotransmitters, which are released in response to an electrical spike called "action potential". Neurons are like computer transistors in one way -they also transmit information in the binary language of 1's (action potential firing) and 0's (no action potential firing). But unlike computer transistors, the brain's neurons are continuously changing.

Using this technology up to 10 implants could be inserted inside on the hemisphere of the brain. Small threads, under the scalp coming from a conductive coil behind the ear, can be bored into the brain. This conductive coil connects wirelessly through the skin to a wearable device that the company calls the Link, which contains a Bluetooth radio and a battery. A single USB-C cable provides full-bandwidth data streaming from the device to a smartphone or computer, simultaneously recording all chip channels.

Controlled via a smartphone app, the Link can be used to make software updates and fix bugs via Bluetooth, avoiding the need to tamper with the chip. Once the Link is

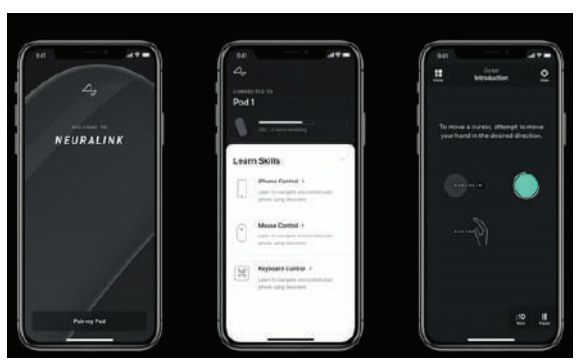


Figure 2: Live data from the brain can be transmitted to personal devices

taken off, the implant is shut down.
The first features being added to the links app include iPhone control, mouse control and the Keyboard control. These controlling features are gonna be skills just like typing. Typing for the first time is a slow process and it becomes fast as practice increases. In the same way mind control is also going to be difficult for beginners.

THE HARDEST KNOWN SUBSTANCE
IN THE UNIVERSE (NUCLEAR PASTA)

Last year a paper came out in the journal Physical Review Letters, that describes what may be the strongest material in the universe. It's called Nuclear Pasta. It's found inside Neutron Stars: (A neutron star is the collapsed core of a large star which before collapse had a total of between 10 and 29 solar masses. Neutron stars are the smallest and densest stars, not counting hypothetical quark stars and strange stars. They are, in fact, made mostly of neutrons.)

The Neutron Star's crust is formed by neutrons that are forced into crystal lattice by the star's extreme gravity (that's why the crust is brittle). A pretty cool consequence of that brittleness is that the crust breaks if put under enough strain. And crust braking can cause all kinds of behavior, like an increase in rotational speed and magnetic outbursts. Just beneath that outer crust lies the Nuclear Pasta, which was first proposed in the 1980s.

This material is formed when, at high pressures, the star neutrons and any surviving protons are compressed so much that they start organizing themselves into some really odd structures. For example, they form very long strings, called Spaghetti and these board-like shape, called Lasagna.

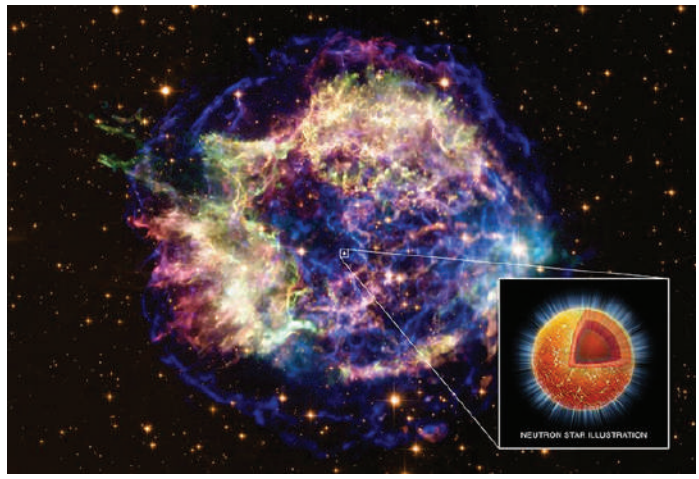


Image Credit: X-ray: NASA/CXC/UNAM/Ioffe/D.Page, P. Shternin et al

Apart from its shape and the general composition, we didn't know much about its characteristics. Like, if the crust can break, can the Pasta? In an effort to figure out what was going on down there, a team from McGill University, Indiana University and the California Institute of Technology ran the largest computer simulations of this material. They tested it under all kinds of stretching and strain, trying to get it to break, and it turns out it needed a lot of strain, making it potentially the strongest stuff in the universe. This pasta layer might also influence how the crust above it breaks. That means that, when astronomers get data from a neutron star's crust, they might be able to extrapolate what's going on in the pasta below. Thanks to their computer simulations, which required 2 million hours' worth of processor time or the equivalent of 250 years on a laptop with a single good GPU.

> "Our results are valuable for astronomers who study neutron stars. Their outer layer is the part we actually observe, so we need to understand that in order to interpret astronomical observations of these stars,"
>
> **Matthew Caplan**

The findings, accepted for publication in Physical Review Letters, could help astrophysicists better understand gravitational waves like those detected last years when two neutron stars collided. Their new results even suggest that lone

neutron stars might generate small gravitational waves.

Image Credit: M. E. Caplan and C. J. Horowitz

"A lot of interesting physics is going on here under extreme conditions and so understanding the physical properties of a neutron star is a way for scientists to test their theories and models, with this result, many problems need to be revisited. How large a mountain can you build on a neutron star before the crust breaks and it collapses? What will it look like? And most importantly, how can astronomers observe it?"

Matthew Caplan

ANALYSIS OF VORTEX-INDUCED VIBRATIONS OVER A CYLINDERS

INTRODUCTION

In this project, vortex-induced vibrations of multiple cylinders were analyzed using ANSYS simulation. First, for flow analysis over multiple cylinders, ANSYS Fluent is used and then for of one-cylinder vibrational analysis, simulation is performed on ANSYS CFX rigid body solver. The cylinder is treated as a rigid body for 3-D analysis and 2D for multiple cylinders, using water as a fluid. For fluent, the three main heat exchanger tube bank arrangements; triangular, rectangular and diagonal, are considered on the basis of literature.

METHODOLOGY:

The analysis of vortex-induced vibrations over a cylinder is divided into two portions:

- 2D-Simulations (Fluent) and Flow Analysis.
- 3D-Simulations (CFX) and rigid body vibrational analysis.

For the first portion of the analysis, the geometry was designed using Fluent. Once the design part is done, it is time to launch ANSYS Fluent and keep the dimensions 2D with double precision and flow analysis type to transient. Next, define a fluid of your choice with a viscosity of one. The ANSYS CFX is a 3D solver due to which no 2D model can be imported in it. So for the analysis, the model is extruded in z-direction which makes the analysis possible. For the next portion of the analysis, the simulation model of the 3D structure is developed. For the 3D simulations, velocities were kept low ranging from 2 to 15 and the Reynold's number was varied from 2000 to 12000. In the 3D analysis, the cylinder is considered as a free beam structure so all the conditions of the free beam can be applied to the cylinder. For this second portion of the analysis, SAS-SST turbulence scheme was applied.

RESULTS AND CONCLUSION:

All the simulations are based on low Reynold's number and these simulations predicted that triangular arrangement is best

suited for heat exchangers operated in that range which is practically an impossible case. From the above results it is concluded that the SAS-SST turbulence scheme used for this simulation is well suited to this type of case. More accurate results can beachieved if small increments in the reduced velocity were used with a finer grid.

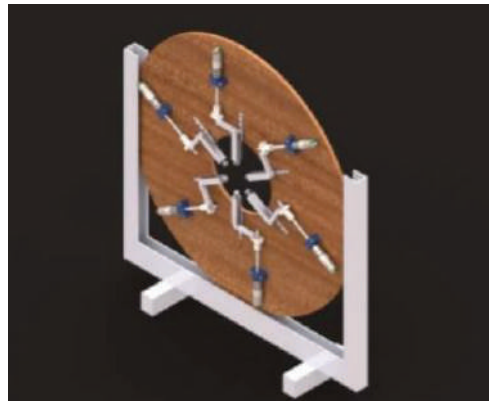
APPLICATIONS:

The study of Vortex-Induced Vibrations can help engineers to increase the durability of mechanical systems and prevent their failure. Following are some applications of studying VIV:

- Vortex-induced vibrations cannot be neglected in civil engineering structures. In civil structures same the phenomenon of vortex shedding is produced and due to this vortex shedding vortex-induced vibrations take place. To prevent failure of such structures, engineers study VIV in detail and introduce measures to increase durability.
- Heat Exchangers are used for either cooling or heating purposes. Heat exchangers are the backbone of the industry . Shell and tube heat exchangers are prone to vortex-induced vibrations. In such heat exchangers, the bank of a bundle of tubes is vulnerable to high speed fluid. These vibrations cause mechanical damages like tube baffle damage, tube collision damage, tube joint leakage, and fatigue. If we want a safe heat exchanger, then it is necessary to minimize these vibrations so that economic loss due to heat exchanger's failure could be avoided.

3D HUMAN LIMB PROFILER

INTRODUCTION:



The design of wearable prosthesis is now a big concern in this modern era because these prostheses are interfaced mechanically with an amputee. Conventional sockets are designed in such a way to apply inappropriate pressure on an amputee. This in-appropriate pressure distribution mostly affects
both prosthesis and residuum. Prosthesis sometimes gets damaged and cracked. Skin problems such as blisters, dermatitis, edema, ulcers, and skin irritation are also usually experienced by an amputee and cause discomfort in the residuum. This type of pressure distribution depends on the geometry of
residuum, biomechanical properties (such as stiffness) and stress properties of residuum. Such properties vary from person to person. To tackle these problems, it is needed to measure biomechanical properties and geometry of a residuum. The Prosthetic socket should be completely fit in with the human body. Such kind of fitting makes prosthetic comfortable and reliable. Compliance in prosthetic sockets is responsible for normal pressure distribution which is the main reason for pain, blisters, sores, and discomfort. Measurement of biomechanical properties and geometry of a contour play an important role to design prosthetic socket.

METHODOLOGY:

The indenter device employs 9 Degrees of Freedom (DOF) system (six for linear actuators, one passive rotational DOF and two for a frame for frame translation motion). It contains 6 positions and forces controllable linear actuators. These actuators surround the limb in circumferential rings and are capable of measuring the stiffness of the residual limb as single

point readings while the limb is clamped by the other 5 actuators.

- Measuring the Stiffness of the Skin
- Mapping Stiffness data on 3D profile of limb
- Manufacturing Prosthetic according to collected data
- Testing the Prosthetics

APPLICATIONS:

- Design of Comfortable Prosthetics.
- Design of comfortable exoskeletons.
- Mathematical Modeling of Skin Tissues.
- To determine the course of a Disease.
- This data can be used in cosmetic surgeries to prevent skin aging effect.

DEVELOPMENT OF NEW DAMS FOR ENHANCING WATER STORAGE IN PAKISTAN

OBJECTIVES:

The objectives of this research are as follows:

- To study the scarcity of water in Pakistan.
- To synthesize the knowledge, capacity and policy gaps with regard to storage development.
- To study the varying degree of success in water storage development.
- To study the pros and cons of all proposed and under-construction dams.
- To point out different associated challenges, problems, flaws, and gaps regarding the development of new dams.
- To draw conclusion after analyzing the available data.
- To propose recommendations for the development of new water storages

With the increase in population of Pakistan, the per capita available water is decreasing. There is a significant reduction in the storage capacities of already built dams due to sedimentation and other problems. If sufficient steps are not taken presently, Pakistan would inevitably become a water scarce country in the future. Pakistan is one of the countries which could face severe food and water crisis as we advance in the 21 century. Due to increased competition for water resources domestic and industrial sectors, major cities in Pakistan are already facing acute shortages of water. This has resulted in groundwater over-extraction, deteriorated water quality and extensive decline of groundwater tables. So, this research project is conducted by the civil department to give the solution of these problems.

Their results show a detailed overview of new Dams that can be built in Pakistan.

1. Diamer Basha Dam
2. Munda Dam
3. Kurram Tangi Dam
4. Akhori Dam
5. Sukleji Dam
6. Skardu Dam
7. Kalabagh Dam

8. Murunj Dam
9. Shyok Dam
10. Hingol Dam
11. Naulong Dam
12. Winder Dam
13. Garuk Dam
14. Pelar Dam
15. Nai Gaj Dam
16. Darawat Dam
17. Bara Dam
18. DarabanDam
19. Tank Zam Dam
20. Ghabir Dam

CONCLUSION:

For better water management, 40% of total water availability is required for storage, but Pakistan's storage capacity is only about 9% which will be increased to 23% (of total available water). Surplus water of at least 18 to 20 MAF is available for immediate development. Pakistan has a water storage capacity of only 9% of the total inflow which barely the storage of 30 days. The Storage capacity of all the existing dams will be reduced by approximately 37% and 53% of the total storage by the year 2025 and 2050 respectively due to sedimentation

MACHINE SIGNAL BASED PULSE ANALYSIS FOR DISEASEDENTIFICATION

INTRODUCTION:

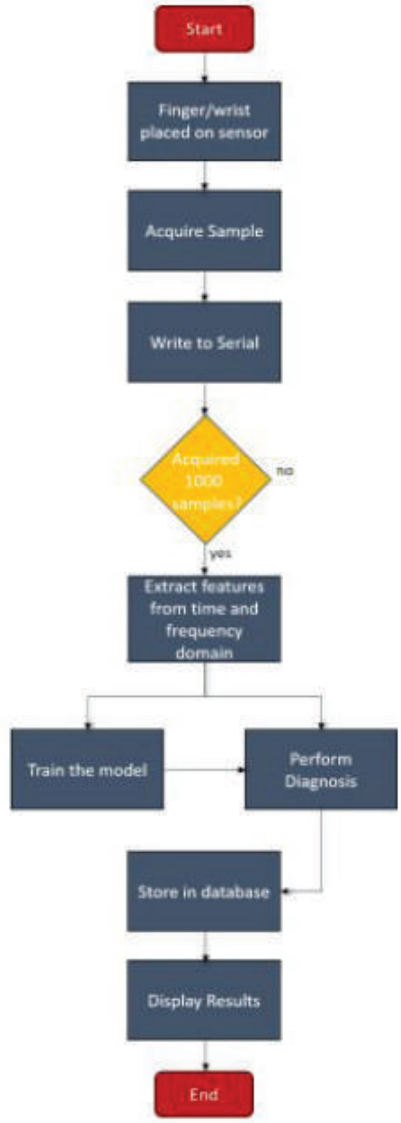
Pulse reading comes from ancient times when the man had not discovered allopathy or homeopathy. The diagnosis was not based upon symptoms; it was centered around the pulse. Symptoms were inquired but the expertise of a practitioner was understood by his ability to understand a person's condition by reading only the pulse. Sadly today, people believe this to be mere hit and trial. The purpose of this project is to develop a pulse diagnosis prototype that acquires the pulse signal and employs the concepts of Unani practitioners via artificial intelligence for prediction of diseases via an efficient and non-invasive method.

METHODOLOGY:

The pulse signal was to be acquired in order to start understanding it. Two sensors were used to acquire the signal. The first one was the pulse oximeter while the second one was a piezoelectric sensor. The general methodology is explained with the help of the following flowchart illustrated

RESULTS AND CONCLUSION:

Feature extraction along with machine learning proved a comprehenscive method to translate the knowledge of a Hakeem into ca language understandable by the machine. This system proved that diagnosis based on the pulse is indeed scientific. This effort resulted in a prototype to diagnose diabetics without going through an invasive laboratory test.



APPLICATIONS:

It can be

- an efficient, robust non-invasive method for disease identificationc
- used to diagnose unconscious patients right away
- used to train doctors
- used to test the impact of specific factors on health, such as exercise, physiotherapy, dietary supplements, diet, etc.
- used for research on exercise and fitness of the human body and diseases related to the human body

NEO-NEST
IOT ENABLED INFANT INCUBATOR

INTRODUCTION:

The first month is most important for the life of a newborn and most of the deaths happen in the first month of life. Therefore, there is a need to pay special attention to the neonatal department in order to save newborns. A newborn premature baby requires an optimum environment condition similar to a mother's womb in order to survive. An Infant incubator provides a similar environment and helps in the survival of the baby. Since, premature babies lack body fat; they are less likely to regulate and maintain body temperature, humidity and oxygen levels. Therefore, the infant incubator ensures the optimum environmental conditions by either allowing these parameters to be adjusted manually or automatically based on changes in the baby's temperature. So, A team from the CS department UET provides a solution to the problem described above by developing

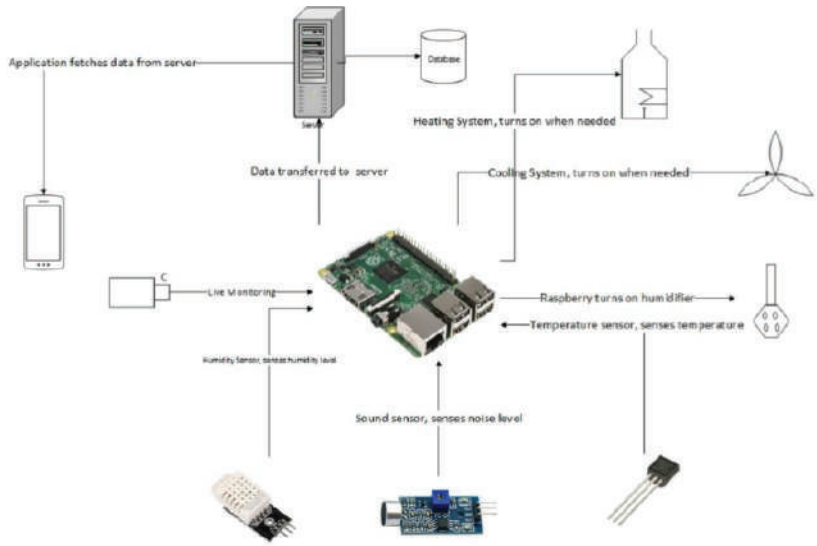
- An economical IOT based infant incubator with automatically controlled optimum conditions i.e. temperature, humidity and other essential factors.
- A camera-enabled monitoring using application that shows previous stats and generates an emergency alarm based on previous learning to minimize the death rate.
- The new advanced shape of an incubator to improvise the cleanliness of the incubator.

MATERIAL CHOSEN:

The final things that we are chosen are:

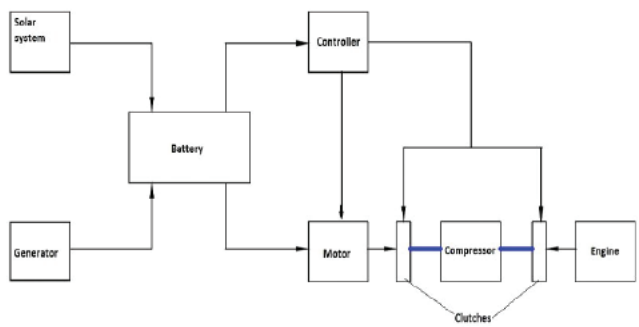
- DS18b20
- DHT11 or DHT222 (based on which one is easily available)
- Raspberry Pi 3 for automated system
- Arduino Uno for manual system
- 16 x 2 LCD for Display
- 4 x 4 Keypad
- DC Fans (12V/5V)
- Humidifier
- Bulb
- RPi Camera
- Laptop to use Android Studio •
- Relays
- Other support items like Jumper Wires, Bread-Boards, PCB chips.

The system is capable enough to automatically control the temperature of the premature baby
by using a heater. Moreover, it controls the humidifier according to the humidity levels inside the chamber. In order to reduce thermal loss from the body, it is important to control the humidity levels inside the chamber. It was found out in our research that it is difficult to clean the corner of the dome so we designed a dome with round corners to make the cleaning of dome easier.



DEVELOPMENT OF THE ENGINE FREE WORKING OF THE AIR CONDITIONING SYSTEM VEHICLES

The road transport sector, in particular, is one of the largest greenhouse gas emitters and energy consumers. About 20% of the world's co2 is produced by the transport sector. Air conditioning is a mechanical process for controlling the humidity, temperature, cleanliness and circulation of air in buildings and rooms.
The compressor of the air conditioner of the car runs on the engine shaft with the help of the belt and a magnetic clutch. A significant amount of the engine power is being used to run the system of the air conditioner in the car which not only increases the fuel consumption but also increase the load and RPM of the engine.



The main focus of this project is to run the Air Conditioning system of the vehicle on the solar power energy and their simulation and optimization results, calculation of the contribution of solar energy towards saving the money and fuel and especially its effect on saving the future of the coming generation by reducing the production of GHG emissions, the annual power that can be generated by the system, net cooling load and Amount of the reduction of the CO2 emissions calculated by different software like The RETscreen Expert and Career HAP.

CONCLUSION:

- If we run the vehicle on this system it will save up to 75 Pkr in one charge.
- 2257.8 tons of CO2 can be saved by using this system. Means 5250.7 Barrels of crude oil will not be consumed.

ELECTROPHORETIC DEPOSITION OF FUNCTIONAL MATERIAL (BI0.5NA0.5)1–X BAXTIO3 ON A FLEXIBLE SUBSTRATE (NI)

INTRODUCTION:

The objective of the following research is to investigate and study the design of a new system of Bismuth Sodium Titanate based lead-free piezoelectric ceramics and suggest if any improvements can be made for making it more sustainable and environmentally friendly in parallel with the enhancement of Bismuth Sodium Titanate based lead-free piezoelectric ceramics with appropriate symmetry.

Piezoelectricity is the accumulation of electrical charges across the sides of a crystalline material when it is subjected to mechanical stress, or vice versa. The PZT-based piezoelectric ceramics contain a very high percentage by weight of toxic lead oxide. So, this research is carried out to study a new system which is lead-free and more sustainable. So, we are going to design a new system of BNT based lead-free piezoelectric ceramics.

CONCLUSION:

Ba doped polycrystalline BNT, with rhombohedral crystal structure having space group R3c was synthesized successfully.

RETRO FITMENT OF SERPENT-1 ROBOT INTO COLLABORATIVE ROBOT

INTRODUCTION:

The main purpose of our project is the incorporation of collaboration in Serpent-1 Robot. First, we needed to troubleshoot the Robot and find its faults and rectify its mechanical problems. Then, Impedance Control scheme is implemented on the Robot. For this, FSRs are attached to the end effector so that the Robot can be controlled by applying a force on the FSRs. The programming is done on Arduino which is interfaced with a MATLAB GUI.

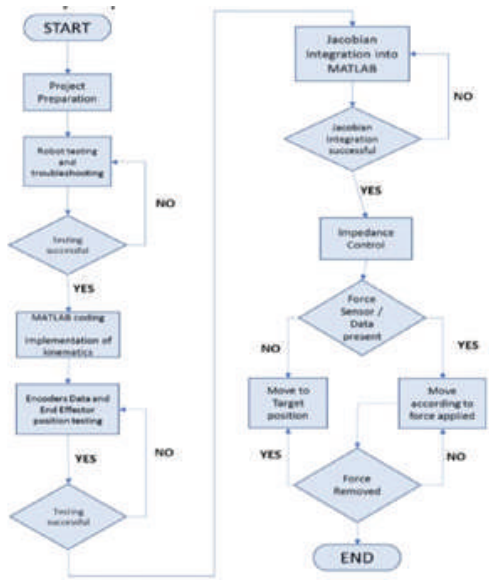
EQUIPMENT & SOFTWARES:

- Force Sensitive Resistance (FSRs)
- Serpent Robot

- Current Sensor
- Motor Driver
- Power Supply
- Encoder
- Arduino
- MATLAB

METHODOLOGY:

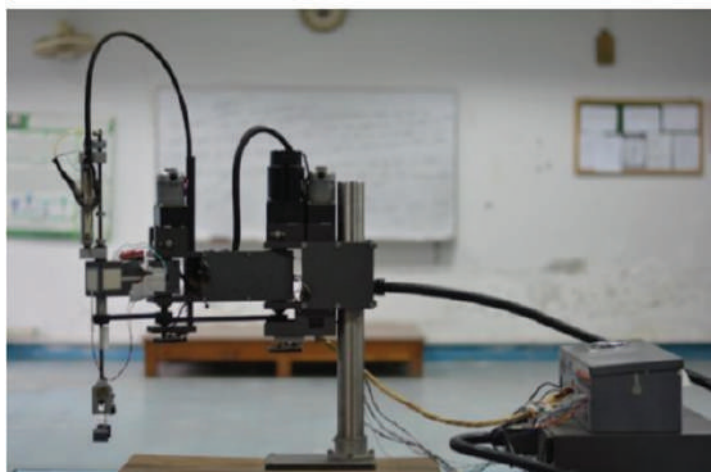
The first step was troubleshooting the problems and bringing it in working then applying the concepts of forward and reverse kinematics. In the next step we implemented force control and then take the force as feedback through sensors. Then after implementation of impedance Control we implemented the collaboration behaviour on the robot. Then we tested these robots in the presence of the human worker in the working space.



1. Troubleshooting
2. Forward and Reverse Kinematics
3. Force Control
4. Force Feedback
5. Impedance Control
6. 0-G Collaborative Robot
7. Final Testing

APPLICATIONS:

- 0-G Collaborative Robot
- Pick and Place Exercises
- Learning and performing repetitive jobs
- Lifting heavy load as per worker requirement
- Works safely in a complex environment

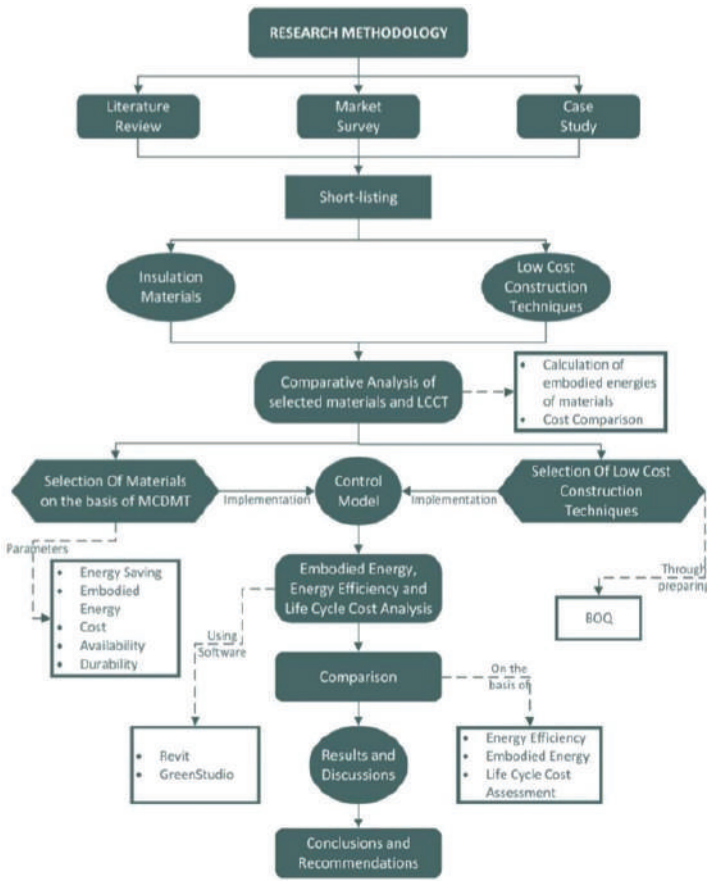


CONSTRUCTION SOLUTIONS FOR LOW COST ENERGY EFFICIENT RESIDENTIAL BUILDING WITH REDUCED EMBODIED ENVIRONMENTAL IMPACTS BASED ON ITS LIFE CYCLE MULTI CRITERIA ANALYSIS

INTRODUCTION:

The prime objectives of the project include,

- To select the best possible insulating material for residential buildings, using multicriteria decision-making technique.
- To propose energy-efficient and low-cost design solutions for residential buildings by implementing selected techniques.
- To analyze the life cycle cost of this sustainable design, to determine the payback of investment.



METHODOLOGY:

The research methodology of this project started with four areas, including literature review, market survey, case studies and a control model. On the basis of these areas, construction and insulation materials and construction techniques were listed down. Further, to provide a solid ground for the selection, multi-criteria decision-making technique (MCDMT), AHP (Analytical Hierarchy Process), was used to select insulation materials. Then, with the usage of different software, these materials and techniques were implemented on the control model. Comparison of control model, before and after the application of selected materials & techniques was done on the basis of various parameters like embodied energy, cost and energy efficiency and results and recommendations were generated.

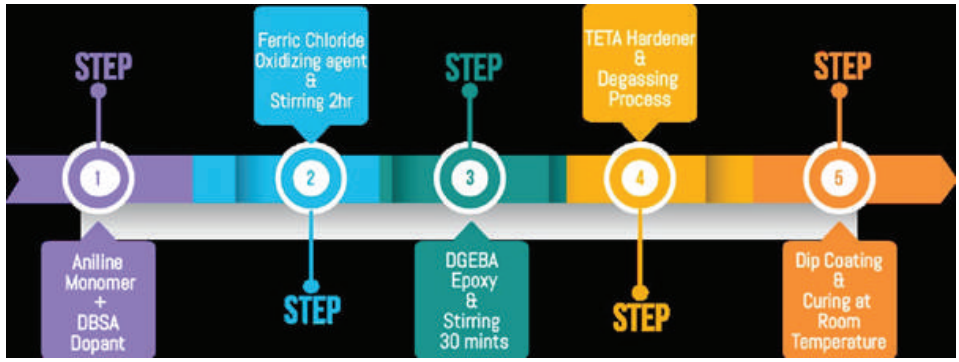
SCOPE:

One of many scopes of the project is to achieve an energy-efficient, low-cost, sustainable design of residential buildings, by using BIM, with application of materials that are sustainable and have lower values of embodied energy, along with low-cost construction techniques. The other scope of the project includes the life cycle cost assessment of the building, after the implementation of materials and low-cost techniques.

DEVELOPMENT AND CHARACTERIZATION OF EPOXY BASED ANTI-CORROSION COATING INCORPORATING CONDUCTING POLYANILINE FOR BURIED PIPES

INTRODUCTION:

This whole study is to form an excellent anti-corrosion epoxy-basedPANI coating in order to enhance the lifetime of buried pipelines and to reduce the corrosion. Our motive is to enhance protection against corrosion of steel pipelines underneath the ground by painting it with polyaniline with epoxy coatings when subjected to severe corrosive medium with corrosive chemicals.



METHODOLOGY:

Two samples with different PANI-DBSA ratios were prepared and characterized by several tests and techniques. The morphology and chemical structure were investigated by FTIR. Adhesion test was performed in accordance with ASTM D3359. TGA results showed the weight loss with temperature, polyaniline started to degrade above 310 °C while the epoxy resin degraded at 210 °C. Dry film thickness was measured to be 112 ± 4 for both samples. For immersion test, the coated samples were immersed for 30 days in a 3.5% NaCl solution. For 0.5M aniline 0.2M DBSA (EP2), coating showed protective nature when immersed in NaCl solution for 30 days and gave better adhesion strength than 0.6M aniline-0.2M DBSA (EP1). Salt spray test for corrosion investigation was performed according to ASTM B117, for EP2 the penetration of corrosion was observed.

CONCLUSION:

Corrosion resistive, epoxy-polyaniline coating has been successfully synthesized by in-situ polymerization of aniline with DBSA dopant for buried steel gas pipelines. It is further concluded that high concentration of Polyaniline reduces adhesion between substrate and the coating. Sample EP2 gave better adhesion strength and also showed better corrosion protective nature and resulted in a lower level of corrosion when immersed in 3.5% NaCl solution for 30 days.

APPLICATIONS:

Epoxy based coatings incorporating conducting polyaniline has various applications worldwide such as coatings of the

buried steel pipelines for gas transmission. These pipes are kept under severe environmental conditions. These coatings help them sustain over a larger life span. Secondly these coatings can be used for anti-fouling in marine applications and for corrosion protection. These corrosion resistant coatings can be used in various industries in many other applications such as automobile, aerospace, power generation, defense, seals, utility, magnetic storage devices, optical equipment, and bearing and in engine parts. Other than anti-corrosion properties these coatings have other features low wettability, low roughness, and low thickness which make them attractive for customers.

ISIGHT: COMPUTER VISION AND ULTRASONIC SENSOR BASED SMART CANE AND GLASSES FOR VISUALLY IMPAIRED PEOPLE

INTRODUCTION:

With the advancement of technologies, more and more gadgets are being developed to help the disable and needy people in the world. Similarly, although, many equipments are prepared for the blind people but due to the high cost or less reliability blind people still have to suffer different problems. So, iSight is a state-of-the-art device that helps blind people in daily life to overcome navigation and identification issues. Its aim is to develop an integrated smart device that can help visually impaired people make their lives easier, better and a bit less demanding.

METHODOLOGY:

The proposed system is basically an embedded system integrating the following components:

- a set of ultrasonic sensors
- a pi-camera
- smoke sensor
- water sensor with microcontroller Raspberry Pi 3 B+

WORKING:

- Ultrasonic waves from ultrasonic sensors are sent out through the transmitter and after reflection from the obstacle they are received by the receiver for obstacle detection.
- A decision tree algorithm uses artificial intelligence algorithms to process this information and taking appropriate decisions to guide the user.
- Next, HAAR object detector (image detector) works by calculating an integral image of a grayscale image similar to an integral over a function in calculus for face detection.
- OpenCV consisting of the camera module is used for face recognition. It collects the dataset of the faces, finds a 128-d vector of face embedding for each person to recognize it.
- Water sensor consists of simple transistor circuit with two ends of the transistor connected to two probes.

As soon as the stick will come in contact with water or muddy surface, the two probes will be connected through ions in

water and the output of transistor will detect presence of water. And last are the smoke sensors.

CONCLUSION:

Conclusively, smart cane and glasses are a complete product for the blind community allowing them to move in the society independently. It is an attempt to provide them maximum features in a low budget keeping in view the performance, quality and specifications. The future aspects of this product include money bill detection, better design and modular approach towards the components. All the features will be tested to measure their accuracy, range and response time. The value of response time of all readings and outputs must be low enough to inform the user about the obstacles, danger and objects around him/her.

APPLICATIONS:

- It can be used for people with complete blindness (permanent or temporary).
- It can be also beneficial for âdyschromatopsiaâ i.e. people with color blindness.
- The device will also help the person with night blindness in routine tasks: in navigating, detecting obstacles, recog nizing people and identifying objects.
- The target audience of this device includes every kind of visually impaired (reduced ability to see) person.
- It is also useful for unprivileged people since it is cheap.

PROSPECTS OF GROUNDWATER RECHARGE OF PAKISTAN

OBJECTIVE:

The broad objectives of this paper are to estimate total water potential of Pakistan, look at the current groundwater exploitation, determine issues related to groundwater recharge regarding abstraction and recharge through seepage, prepare recommendations for sustainable use of groundwater, look at the incentives taken by government for groundwater recharge.

Countries	Precipitation	Ground Water (MAF)	River Flow (MAF)
India	1083	350	1515
Bangladesh	2666	17	978
Nepal	1500	16	170
Sri Lanka	1712	6	42
Bhutan	2200	6	63
Maldives	1972	0.02	0
Pakistan	494	45	194

METHODS OF GROUNDWATER RECHARGE:

- Spreading Basins
- Recharge Pits and shafts
- Ditch-and Furrow Method
- Flooding Method
- Irrigation Method
- Recharge Well
- Conjunctive wells

Table 5: Average Water Diverted into Canals of all Provinces

Provinces	Kharif	Rabi	Total
Punjab	34.78	17.00	50.40
Sindh	27.55	12.26	38.63
KPK	3.02	1.81	4.83
Baluchistan	2.39	0.93	3.32
Average	66.98	30.19	97.17

METHODOLOGY:

- The data of inflows and outflows is collected from rivers and canals, flow downstream of Kotri Barrage, precipitation (rainfall) and the number of tubewells in Pakistan.
- Data regarding the total number of tubewells were collected from different development statistics reports of all the provinces of Pakistan and combined to get the total number of tubewells which was required to estimate the discharge and utilization factor of tube-wells.
- First, the data is plotted in the form of line graphs and bar charts to find out the trend of data variation. To reduce the variation an average value is considered in the calculations.
- Data of 4 to 5 years is considered in the calculations.
- Utilization factor was calculated separately for both electric and diesel type of tubewells.
- Utilization factors are dealt with separately for both Rabi and Kharif seasons.
- The recharge of groundwater through seepage from all the main sources of water was calculated.
- The amount of groundwater recharge by seepage through canals, watercourses, field crops, etc. were taken into consideration.

Table 8: Capacity Loss of Some Important Reservoirs of Pakistan

Reservoir	Designed capacity (MAF)	Existing capacity (MAF)	Capacity lost (%)
Tarbela Dam	9.68	6.047	38
Mangla Dam	5.34	4.49/7.39	16
Chashma Barrage	0.72	0.23	68
Total	15.74	13.67	13

RESULTS:

The value of water balance budget is negative which indicates that the abstraction through tube wells is more than the recharge through seepage. That water balance budget also helps us calculate the time frame up to which we can draw water from groundwater aquifer up till its full depletion.

RECOMMENDATIONS FOR WATER BALANCE:

- We should ensure the proper check and balance in the usage and extraction of underground water.
- We should use efficient irrigation method.
- Avoid lining of canals and water resources.
- Adopt recharging techniques for underground water recharging.
- Raise awareness campaigns for proper usage of underground water.

SYNOPSIS FOR INTELLIGENT TRANSPORTATION SYSTEM IN PAKISTAN

INTRODUCTION:

Pakistan rapidly transformed over the years in terms of development, increased motor revolution cause problems related to health, security and environment. We lack:

- Technology advanced infrastructure
- Traffic claiming procedures
- Pakistan traffic police has no speed radars

Which create difficulties to control and manage traffic upto required extent. Traffic congestion is caused by multiple causes.

The purpose of the study described in this thesis is:

- To determine which Intelligent Transportation System applications are being used in Lahore By Punjab Safe City Authority
- Study of these Intelligent Transportation System applications
- Propose any improvements and suggest new Intelligent Transportation System applications in other fields of Transportation Engineering

SOFTWARES:

ITS is the latest development in the field of transportation system. ITS combines a wide range of sensing, processing, analyzing and data transferring technologies and disciplines to provide real time traffic information to the users electronically. Lahore is in the need to have ITS for operating public transportation. Intelligent Transportation System Applications used by Punjab Safe City Authority in Lahore:

- Red light violation system
- Automatic Number Plate Recognition (ANPR)
- Traffic counts and signal priority system
- Journey time measuring system (JTMS)

RESEARCH METHODOLOGY:

This research was carried out on 5 different locations of Lahore, major intersections are equipped with ITS based technologies. Questionnaire survey was conducted to collect data about commuter perception regarding ITS and its implementations. A total number of 600 surveys were filled at different locations by all types of commuters.

CONCLUSION & RECOMMENDATION:

It is concluded from the above research that PCSA uses many applications of ITS like:

- Red light monitoring system (RLMS)
- Police Traffic signal control (PTSC)
- Electronic ticketing (E- Challan)

Some more improvements are made by PSCA :

- Green Environment
- Character recognition algorithm
- License Plate Traffic survey
- Bus/Bike lane enforcement

Moreover different methods are conducted to aware the public about ITS and its applications.

DESIGN OF MAGNETIC REFRIGERATION SYSTEM

INTRODUCTION:

Magnetic refrigeration is a cooling technology based on magneto-caloric effect. This technique can be used to attain so much low temperature below 1K, as well as the ranges used in common refrigerators. It is a physical process that exploits the magnetic properties of certain solid materials to produce refrigeration. The refrigerant is often a paramagnetic salt, such as cerium magnesium nitrate. It gives cooling near absolute zero than any other method. Hence it made liquefaction of gases easier and does not emit any CFC and HCFC compounds. That is why it never affects our environment, especially the ozone layer.

MAGNETO-CALORIC EFFECT:

MCE is a magnetic thermodynamic phenomenon in which a reversible change in temperature of a suitable material is caused by exposing the material to a changing magnetic field. All magnets bear a property called Currie Effect i.e. if a temperature of the magnet is increased from lower to higher range at a certain temperature then magnet loses its magnetic field. Curie temperature depends upon material individual property.

CONSTRUCTION OF MAGNETIC REFRIGERATION SYSTEM:

Components required for the construction are.

- Magnets
- Hot heat exchanger

- Cold heat exchanger
- Drive
- Magneto-caloric wheel

BENEFITS

- Higher efficiency
- Low capital cost
- Simple design
- Low capital cost and noiseless technology

DRAWBACKS

- Moving machines need high precision
- Permanent magnets have limited field strength

CONCLUSION:

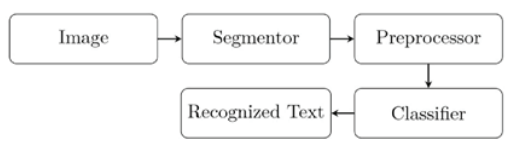
Magnetic refrigeration is undoubtedly a promising technology that should be encouraged because of its numerous advantages in particular energy saving and environmental benefits.

URDU HANDWRITING RECOGNITION USING DEEP LEARNING

INTRODUCTION:

Optical character recognition aims to recognize text in images. Recent breakthroughs in deep learning have revolutionized OCR systems for languages such as English. However, the impact on Urdu has been minimal. This project aims to bridge this gap.

METHODOLOGY:



We develop a new dataset comprising of around 15,000 images of Urdu handwritten text lines and used it to train different deep learning architectures. The first is the standard CNN-RNN architecture that optimizes the Connectionist Temporal Classification function. We also incorporate a trigram language model with this architecture to further improve performance. The second architecture is an attention-based encoder-decoder network that optimizes the cross-entropy function for each character in the transcription. We achieve accuracies of 91.51% and 90.07% on the two architectures respectively. These results are comparable to the state-of-the-art results on English datasets.

CONCLUSION & FUTURE WORKS:

A number of improvements may be made in the future.

- Firstly, the dataset may be expanded to include, for example, images of multi-lingual handwritten documents.
- Secondly, one major drawback of the architecture presented is that future decisions made by the network cannot affect its past decisions.
- Thirdly, future work may involve combining the predictions of different networks. This is because different networks usually learn different things like human minds do. Some are good at identifying certain characters while others are good at identifying others.

Reviews & Articles

THERE EXISTS NO PLAN ''B''

CLIMATE EMERGENCY

The United Nations High-level Political Forum on Sustainable development in New York on July 9, 2019, concluded with calls for increased climate action as a crucial factor to achieve goals.

Climate change is more than a great threat with the danger of humanity's worst challenges like health, poverty, and hunger. The 17 SDGs are specified in the 2030 Agenda for Sustainable Development. In this era, when planet Earth is facing drastic changes in climate, the 2030 Agenda stands to transform the world. Its goals and targets are to change action in next 15 years in the following areas:

- People
- Planet
- Prosperity
- Peace
- Partnership

In addition to the 2030 agenda, another important step towards a healthier environment is the Paris Agreement. Both of them share the purpose of creating a more productive and resilient environment. In this context, the year 2015 marked a milestone in the efforts towards a better and sustainable future. Global warming can still be controlled but to reach a "net-zero" around 2050, we need to reduce the Earth's temperature by 1.5° C annually by controlling the land, energy, industry, buildings, transport, and cities.

The Paris Agreement aims at reducing the temperature globally and is effectively adopted by many countries in a short time. It entered to force on November 4, 2016.

"In the bigger picture, the 2030 Agenda and the Paris Agreement are really about the same things. They provide our biggest opportunity for positive, systematic change that will ensure a resilient, productive and healthy environment for present and future generations." Says the UN climate chief Patricia Espinosa.

The UN Secretary-General, Antonio Guterres, made a two-day visit to Mozambique while the HLPF was taking place, to witness the damage

caused by cyclones Idai and Kenneth, and to take stock of recovery efforts. The major and exhaustive climate changes have made nations realize the need for climate action at all levels of society. The UN and Sony pictures entertainment have together come up with the new theme of "Angry Birds" to emphasize the need to come together and create a more sustainable world, moreover the Act Now campaign is also a global call for citizen action on climate change.

EXCEPTIONAL ELECTRONIC SKIN SYSTEM

With the advancements and great achievement in field of robotics and AI on daily basis, Assistant professor Benjamin Tee and his team from the department of materials science and engineering National University of Singapore (NUS) have achieved the new electronic skin system with ultra-high response and resistance to damage, moreover it can be paired with any kind of sensor skin layers to function as an electronic skin.

The team under Assistant professor Benjamin Tee spent one and half a year to develop a sensor system inspired by the human sensory nervous system that could potentially perform better. The nerve bundles in the human system transmit the signals, implementing such a technique using interlinked wiring systems that are already used in existing electronic skins, can increase the chances of damage and are difficult to extend.

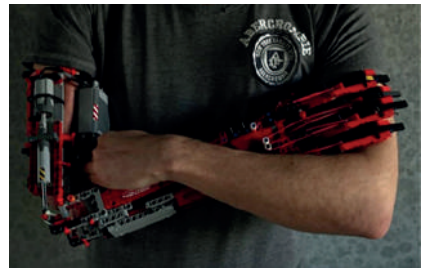
"Humans use their sense of touch to accomplish almost every daily task, such as picking up a cup of coffee or making a handshake. Without it, we will even lose our sense of balance when walking. Similarly, robots need to have a sense of touch to interact better with humans, but robots today still cannot feel objects very well" said Assistant Professor Benjamin Tee while he explained his work as he has been struggling for the last ten years to

Asynchronous Coded Electronic Skin (ACES), an artificial nervous system, developed by a team of researchers from NUS. ACES can help robots and prosthetic devices to sense exactly like human skin or even better than that.

give robots a better sense of touch. He extended "The human sensory nervous system is extremely efficient, and it works all the time to the extent that we often take it for granted. It is also very robust to damage. Our sense of touch, for example, does not get effected when we get a cut. If we can mimic how our biological system works, and make it even better, we can bring about tremendous advancements in the field of robotics where electronic skins are predominantly applied."

The present electronic skins use interconnecting sensors by current systems which is more likely to get damaged, on the other hand, ACES uses a common electrical conductor to connect various sensors operating independently. This feature makes them less likely to damage.

Assistant Professor Benjamin Tee's team also developed self-repairing electronic skin by pairing ACES with a transparent self-healing sensor skin layer. This type of skin can be used in the prosthetic



ACES can differentiate physical contacts between different sensors in less than 60 nanoseconds, it can accurately identify the shape, texture, and hardness of objects within 10 milliseconds which is ten times faster than one blink of an eye. These characteristics make it 1000 times faster than the natural sensory system.

limbs to restore the sense of touch in disabled people.

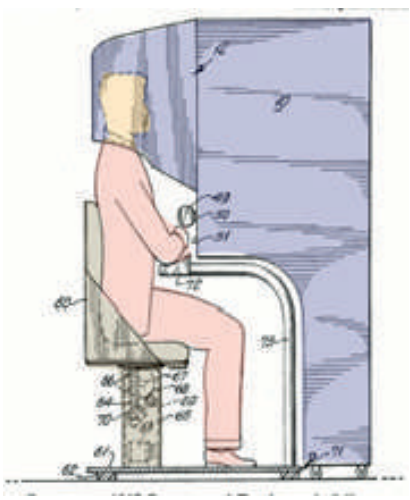
VIRTUAL REALITY- THE FUTURE OF ANIMATION

In today's world, modern technology is developing rapidly as a substitute for all the characteristics of life. The 21st century will be remembered for fast-paced technological development. The basic purpose of every technological advancement is the upward mobility of mankind. One such technology is virtual reality. It is a simulated experience identical to the real world. The primary subject of virtual reality is simulating the vision through computer-generated illusions. Unlike traditional user interfaces, VR places the user directly inside the virtual 3D world and simulates as many senses as possible, such as vision, hearing, and touch. VR uses similar sensors as the augmented reality and takes the user in a virtual world instead of creating virtual objects in the real world.

The idea of virtual reality was first portrayed in the 1930s when the first simulator was invented by the scientists to prepare the pilots by exposing them to an actual flight environment before

being able to fly. The invention got improvement in 1965, when Ivan Sutherland, presented his theory of developing a portable virtual world using two tiny television sets, one meant for each eye. Scientists continued
working on this idea until, in 1985, Michael McGreevy, from NASA introduced an improved version of virtual reality. It was light-weighted, using a motorcycle helmet with mini display screens. It was also provided with the special sensors which were used to detect movements with the help of sensitive computer technology. Finally, during 1986, the invention got its final touch when a programmer, Jaron Lanier, introduced a new glove for virtual reality. In this way, this technology took the modern form.

Virtual reality is taking our society by storm, invading almost every aspect of our lives. With some special equipment such as helmets and gloves, any person can engross himself in a virtual world where he can travel to the moon or learn how to fly a space shuttle. It is commonly used for entertainment such as video



gaming or 3D cinema. It is also helpful in psychology and social sciences since it helps in creating a simulated environment and can be used for curing anxiety disorders such as post-traumatic stress disorder (PTSD) and phobias. There are a wide variety of applications for virtual reality which include architecture, sports, entertainment, arts, and medicine. To engross the users completely in a virtual environment, several effects and sensing elements are included. By using headphones, eye and head tracking by laser sensors, gyroscope, and 3D sound effects, a complete virtual world is created that engages the users due to the convincing milieu. An amazing research is being carried out now a days.

Apart from all the attractions, it also has some dangers. It has several psychological issues such as addiction, brainwashing, effects of interactive violence, and devaluing of the real world. Many people today live more in the virtual world than in the real world. This has made sociopaths out of some of them. They are so used to interacting with people in the virtual world that they no longer know how to interact with people in the real world. The major concern of some critics is that virtual reality will use us in the future by becoming too large for us to control. It may be used so frequently, that humans will use the virtual world as a means of escape from the daily grind of their lives. Mychilo S. Cline argued in 2005 that through virtual reality, techniques will be developed to influence human behavior, interpersonal communication, and cognition.

In the future, we'll see rapid advancements in creating a truly immersing digital experience through virtual reality. We can expect to see many more innovative uses for the technology, and perhaps a fundamental way in which we can communicate and

work. Studies are being carried out to make further improvements in it, and we can predict its importance in the upcoming time due to its vast applications. This superb invention carries great elasticity in it and we can hope to get even better results that will bring great changes in almost every field.

CYBERSECURITY

A few years ago, ‘cyberspace’ was just a term from science fiction used to describe a network of computers linked together. The term "cyberspace" first appeared in fiction in the 1980s in the work of cyberpunk science fiction author William Gibson. Now, the technology has evolved so much that a huge chunk of data is stored in cyberspace. Cyberspace owes its expansion to the swift development of Information Technology and the Internet of Things. It has facilitated the people by making the information easily accessible. The use of this widespread, interconnected technology has become an integral part of the lives of today’s generation. From communicating through messages, emails to online shopping, banking, transport, land records, defense system, and business, it has penetrated every aspect of our lives. According to Chip Morningstar and F. Randall Farmer, cyberspace is defined more by the social interactions involved rather than its technical implementation.

With the increased penetration of the internet and cyberspace in our lives, cybersecurity has become the biggest requisite in the world. It is often quoted that future wars will not be fought on land, water or air, like traditional wars; cyberspace will one day become the greatest theatre of warfare. The wars will be fought with one click of a mouse button. The protection of data from hackers, malware and viruses is the principal challenge of the modern era due to its complexity in politics, military, and technology. Growing cyber threats such as data theft, phishing scandals, and other cyber-

crimes demand that users should remain cautious about shielding data. Securing information from unauthorized access, threats and vulnerabilities via different operations and activities are included in cybersecurity. Serious monetary damage has been caused by these cybercrimes. According to a report of McAfee, the global cost of cybercrime has now reached as much as $600 billion.

Today, computer security comprises mainly "preventive" measures, like firewalls or an exit procedure. The principle of least privilege provides each part of the software with limited access. In this way, even if an attacker gains access to that part of the software, he cannot enter the whole system. The intrusion detection system detects the ongoing attacks to the system and helps in the post forensic attacks. Many hardware protection mechanisms are also used for securing privacy breaches. Some organizations are turning to big data platforms, such as Apache Hadoop, to extend data accessibility and machine learning to detect advanced persistent threats.

But responding to all the security breaches is often very arduous. The attackers generally commit their actions through proxies and anonymous identities and cover their tracks after successful security breaches. The number of attempted attacks is so large that organizations cannot waste time in trailing every attacker. A large number of attacks are made by automated vulnerability scanners or malware. Analysis of the incident, its root cause and the organization's response with the intent of improving the incident response plan and future response efforts is a key component in cybersecurity.

Thus, cybersecurity plays a key role in preventing some heinous and dangerous crimes like leakage of personal information, blackmailing, fraud transactions through another account and hacking of sensitive information of a country. It is essential to understand the different types of risks and vulnerabilities that exist in the Internet world. For every user, it is important to think before connecting to someone using an online medium. Users should also think before sharing any information with other users through the internet.

A MATERIAL WAY TO MAKE MARS HABITABLE

Mars is the most habitable planet in our Solar System besides Earth. But it remains a hostile world for many kinds of life. A system for creating small islands of habitability would allow us to transform Mars in a controlled and scalable way. People have long dreamed of re-shaping the Martian climate to make it livable for humans.

Unlike Earth's polar ice caps, which are made of frozen water, polar ice caps on Mars are a combination of water ice and frozen CO2. Like its gaseous form, frozen CO2 allows sunlight to penetrate while trapping heat. In the summer, this solid-state greenhouse effect creates pockets of warming under the ice.

The Martian surface was eminently habitable in the ancient past, featuring lakes, rivers, and even a huge ocean. But things changed dramatically after the planet lost its global magnetic field about 4 billion years ago. Charged particles from the sun began stripping away Mars' once-thick atmosphere, eventually reducing it to a thin sliver that cannot keep much heat in or UV radiation out. The surface became extremely cold and dry as a result, leaving subterranean aquifers as perhaps the only potential abodes for Earth-like life.

Many discussions about making the Martian surface more hospitable focus on restoring that atmosphere to its former glory beefing it up by vaporizing huge amounts of water ice and frozen carbon dioxide, for example. But such "terraforming" efforts would be extremely difficult, expensive and time-consuming.

The researchers landed on silica aerogel, one of the most insulating materials ever created.

“Silica aerogels are 97 percent porous, meaning that light moves through the material but the interconnecting nanolayers of silicon dioxide infrared radiation and greatly slow the conduction of heat. These aerogels are used in several engineering applications today, including NASA's Mars Exploration Rovers.”

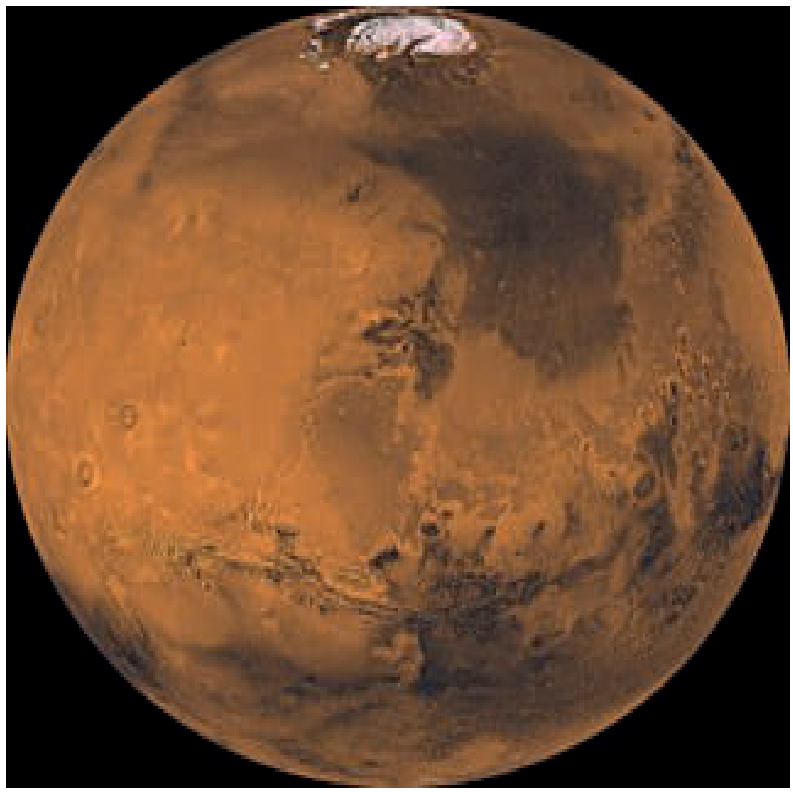


Image Description: Mars as seen from orbit in the 1970s by NASA’s Viking mission

Using modeling and experiments that mimicked the Martian surface, the researchers demonstrated that a thin layer of this material increased average temperatures of mid-latitudes on Mars to Earth-like temperatures.

While working on this material, Wordsworth said:

"Spreading it over a larger area would make the solid-state greenhouse effect more efficient, as the proportional amount of heat emitted from the sides would be less, but you could still get substantial warming in a greenhouse”.

There are also significant ethical considerations. For example, is it right for humanity to take Earth organisms to another planet, especially one that may have had its biosphere in the past and may even have one today?

But researchers and mission planners have been debating such planetary-protection issues for years. And the conversation is only going to get more heated as the quest to put astronauts, and their trillions of hitchhiking microbes, on the Martian surface edges from sci-fi dream to reality.

DIGITAL FORENSICS

When a syringe-wielding drill thief tried sticking up a Home Depot near Yankee Stadium, police figured out quickly that it wasn't a one-off. A man had also used a syringe a few weeks earlier while stealing a drill at another Home Depot 7 miles south in Manhattan. The match, though, wasn't made by an officer looking through files. It was done by pattern-recognition computer software developed by the New York Police Department.

Fingerprint technology has breathed life into cold cases; unsolved crimes have answers now; criminals who thought they got away have been arrested; crimes are being predicted and stopped even before they happen. All thanks to the revolution digital forensics brought into the world of crimes.

Just as in the physical world, we leave traces of ourselves – fingerprints, hairs, clothing fibers, DNA, etc. – when we move and interact with people, places, and objects, so to do activities in the digital realm leave pieces or echoes of themselves. These virtual or digital traces – think file fragments, activity logs, timestamps, metadata, and so on – may be deemed to be of value, for any number of reasons.

They may be useful as evidence in establishing the origins of a document or piece of software, for legal purposes in determining the activities of the parties involved in a criminal case, or even as a resource for cyber-criminals looking to reconstruct information or identifying credentials on their victims.

Whatever the motivation, the examination, interpretation, or reconstruction of trace evidence in the computing environment falls within the realm of digital forensics.

Digital forensics is the "process of identifying, preserving, analyzing and presenting digital evidence in a manner that is legally acceptable in any legal proceedings (i.e., a court of law)." The goal of the process is to preserve any evidence in its most original form while performing a structured investigation by collecting, identifying and validating the digital information to reconstruct past events.

For the security professionals protecting an enterprise – or the investigators working to trace the origins of a breach – any or all of these aspects of forensic digital evidence might be key in documenting an incident, formulating a response, or building a strategy for future operations.

From a scientific standpoint, a study of the activities and methodology of hackers and cyber-criminals, together with digital forensic analysis of the tools and techniques that they employ, may yield insights into prevailing or future attack trends, the workings of cyber-criminal networks, and emerging strains of malware. These can add considerable input to knowledge and best practice resources, and threat intelligence databases.

Since computers, mobile phones, and the internet represent the largest growing resource for criminal perpetrators, digital forensics has assumed a key role in the law enforcement sector. With cyber-crimes offering a high-yield and relatively low-risk opportunity that doesn't require physical violence, law enforcement agencies are now continually engaged in digital forensic activities to curb the exploits of fraudsters, identify thieves, ransomware distributors, and others in the cyber-criminal ecosystem.

Cyber forensics analysts work in a large variety of areas, including government organizations such as federal and local law enforcement institutions. Their primary role is to retrieve hidden, erased, and destroyed data from computers, mobile phones, laptops, USBs, and other storage and computing devices. This data, after being analyzed and restored to its original state, is then used in legal proceedings as digital evidence in criminal investigations or is used by government officials for national security purposes.

In Pakistan, forensic has been ignored for a long time. The ongoing terrorism gave a wake-up call to the establishment and untiring efforts were made for the establishment and proper functioning of the forensic laboratory to help criminal investigations. National Forensic Science Agency (NFSA), Punjab Forensic Science Agency (PFSA), PakCERT and Digital Forensic Research and Service Centre (DFRSA) are the leading names when it comes to

digital forensics. The general public and judiciary of Pakistan are relying heavily on Forensic evidence in trial cases and making decisions. As digital forensics popularity increases in the country so does the backlog. More and more cases are being received each day which is causing a delay in the case processing and ultimately delayed justice. There is a need to increase the capacity and number of the Digital Forensic laboratories across the country as the current facility is insufficient keeping in mind a large number of cases coming from the big population of Pakistan.

FUTURE OF DIGITAL FORENSICS

Despite the field's quick evolution, advancements in digital forensics are now more difficult to achieve. The presence of a mixed set of technologies is increasing the complexity of the problem space to be faced when performing digital investigations. Cloud computing is one of the most controversial emerging areas of digital forensics. Cloud platforms reduce physical control over data and its location. Moreover, they require handling the lack of standard interfaces when developing tools; present issues due to multiple ownerships, tenancies, and jurisdictions; and make the investigation of complex attacks more difficult, mainly because of the lack of collaboration among providers. As defensive measures become increasingly efficient, more aggressive deployment of anti-forensics methods can be envisioned. These encompass encryption, obfuscation, and cloaking techniques, including information hiding. For example, a challenge for filesystem analysis is steganographic configurations, which allows hiding information in unused areas of the hard disk or in metadata, such as timestamps. Except for binary obfuscation, such mechanisms aren't yet widespread, but they could become relevant for digital forensics investigation in the mid-term future.

Luckily, cloud computing can be combined with intelligent automation and visualization tools to aid forensic analysts in highly complex environments. Criminals might be getting smarter and using advanced tools but forensic analysts are doing their best to keep up with them.

Science Rhymes

NEWTON LAWS OF MOTION

by Carolyn Colley

Sir Isaac Newton was his name,
Observing objects was his game.

He made three rules about what he saw,
When we see motion, it's described by the law.

The first law of motion is just a piece of cake,
To make an object move, all it needs is a shake.

The second law of motion is about a force,
Give it a shove and the object takes that course.

The third law of motion is pure satisfaction,
For each force made there's an equal and opposite reaction.

Pushing or pulling, exerting a force
Moving and shaking, its physics, of course!

SCIENTIFIC INQUIRY

by Susan Blackaby

Scientists are like explorers,
using what they know and see
to blaze a trail that, step by step,
will lead to new discoveries:

Formulate, distill and focus,
narrow down, define the gist,
determine scope and pinpoint locus
this is your hypothesis.

Gather all the stuff you need,
to put in play the machinations
Document the happenings
these comprise your observations.

What things change and what things
stick?
Record the outcomes and effects.
Don't presume and don't predict
collect the data: just the facts.

Combine the concrete things you see
with what you know and trials you test.
Interpretation is the key
results are where you end the quest.

QUANTUM ENTANGLEMENT

by Mig Mag

Two particles zooming quickly away
Forever linked no matter where they stray
They've become entangled, their quantum states
Eternally joined in cosmic play

Such is the bond between our souls sublime
Unbroken across all of space-time
We've become entangled, ineffably linked
Our lives fused together in perfect rhyme

AN ENGINEER'S VALENTINE

by Matthew Dalton

I was alone and all was dark
Beneath me and above
My life was full of volts and amps
But not the spark of love

But now that you are here with me
My heart is overjoyed

You've turned the square of my heart
Into a sinusoid

You load things from my memory
Onto my system bus
My life was once assembly code
It's now like C++

I love the way you solder things
My circuits you can fix
The voltage 'cross your diode is
much more than just point six

With your op-amps and resistors
You have built my integrator
I cannot survive without you
You're my function generator

You've changed my world, increased my gain
And made my math discreet
So now I'll end my poem here
Control, Alt, and Delete

SYMMETRY

Physics' beauty burning bright
in mans search for natures might
at its core, simplicity
framed by beautiful symmetry

Whenever natures hand does seize
an object; moving it with ease
then - with opposite, symmetrical tack-
the object seizes nature back

The fundamental particles
no random collection of articles
each does sit in its place in a family tree
grown in deep mathematical symmetry

At the core of physics; the decree
of conservation of energy
is forever entangled intimately
with a strict and time-wise symmetry.

Seeking not the joy of art
but the natures' working chart
dusty eye may shed a tear
as man's vision becomes clear.

Men with fire in their eyes
Privileged – their work their prizes
art and science in synergy
in natures nature - symmetry.

THE ENGINEER

by Stephanie Calmenson

Listen up and you will hear
Why I am called an engineer.

I solve. I build. I invent.
I'd say my time is very well spent.

Want a bridge? I'll design it for you.
Want a new kind of wheel? I'll develop that, too.

I use computers, I use my brain.
I think and test till the answer is plain.

Want a robot, a rocket, an electronic device?
I'll take the assignment; I won't think twice.

I'll make running shoes that will send you soaring!
I'll develop a device that will keep you from snoring!

My life is all about invention,
Making the world work better is my intention.

Study Abroad Scholarships

HIGHER EDUCATION COMMISSION (HEC) PAKISTAN

HEC connects gifted students and faculty with the best research universities in the world through its much sought-after international scholarship program, mostly at graduate level, to study abroad in a range of countries such as the US, the UK, Australia, Germany, France and more.

OVERSEAS SCHOLARSHIPS FOR MS/MPHIL LEADING TO PHD

Scholarships are awarded every year for Direct PhD & MS/MPhil leading to PhD Program under this category. Scholars are placed in those technologically advanced countries that have no/nominal/special tuition fee rates for which HEC and higher education agencies and universities in the host countries have signed Memorandum of Understandings. The process takes almost 10-12 months from scholarship announcement to award of scholarship. These scholarships are for all disciplines however provincial and discipline quota is maintained keeping in view the national needs.

ELIGIBLITY CRITERIA

- Pakistani/AJK nationals
- Candidates must have minimum Eighteen years of education (i.e. MS / ME/ MPhil)
- Maximum two second divisions throughout the academic career
- Maximum age:
  - » 40 years for full time regular faculty members of public sector Universities/Colleges and employees of the public sector R & D organizations
  - » 35 years for all others
- The candidates will have to obtain 50 or above marks in the HEC aptitude/scholarship test.
- The candidates who are already availing any other scholarship are not eligible to apply
- The candidate must have acquired the requisite qualification on or before.

HOW TO APPLY ?

The following documents are required to be submitted along with the printed copy of online application form:

- Attested photocopies of all educational testimonials. Equivalence of the foreign qualification/s from IBCC/ HEC will be provided with the application form.
- Attested photocopy of domicile and CNIC
- Statement of Purpose (One Page)
- CV/Resume
- Research Proposal based on indigenous issues.
- NOC from the employer for in-service candidates (only for Government employees).
- Original online Deposit slip of Rs. 200/- (non-refundable) in favour of the Director General Finance, Higher Education Commission, H-9, Islamabad on account number 0112-00500119-01, HBL Aabpara Branch Islamabad as processing fee (Bank Draft is not acceptable)

Currently Overseas Scholarships (90% Category) is Closed for the Award of New Scholarships

For Scholarships and further detail contact on this

Gul Sher Khan (IT Administrator)

Email: gsher@hec.gov.pk

THE ASIA FOUNDATION DEVELOPMENT FELLOWS PROGRAM

The Asia Foundation Development Fellows: Emerging Leadership for Asia's Future program provides highly qualified, young professionals from Asia with an unparalleled opportunity to strengthen their leadership skills and gain in-depth knowledge of Asia's critical development challenges. The year-long professional advancement program draws on The Asia Foundation's extensive 18-country network and deep expertise working with innovative leaders and communities across the region. The program is designed to be a multifaceted experience, involving intensive learning modules–short courses, conferences, and study tours in Asia and the US–to enhance leadership skills, Asian development knowledge, professional networks, and international exposure.

The application window for our 2019 Asia Foundation Development Fellows is now closed. The application window for the 2020 Asia Foundation Development Fellows program will open in September 2019.

For more details contact at:
https://asiafoundation.org/what-we-do/asia-foundation-development-fellows/

UNIVERSITY OF CANBERRA INTERNATIONAL COURSE MERIT SCHOLARSHIP, AUSTRALIA

- Eligible Countries: India, Nepal, Bangladesh, Pakistan, Sri Lanka, Bhutan, Vietnam, Philippines, and Latin America
- Acceptable Course or Subjects: Bachelor of Engineering in Network and Software Engineering (Honours), Master of Data Science, Bachelor of Biomedical Science, Bachelor of Science, Bachelor of Medical Science, Bachelor of Environmental Science, Bachelor of Health Science, Bachelor of Sports and Exercise Science, Bachelor of Business (International Business), Master of International Business, Master of Law, Master of Marketing Management, and Master of Human Resources Management courses at the university.
- Admissible Criteria: To be considered for this education award, the applicant must be a full-time student who commences study either in Semester 2, 2019 or Semester 1, 2020.

HOW TO APPLY ?

- How to Apply: You need to take admission in one of the given undergraduate or postgraduate degree program at the university. No separate application is required for the grant, you will automatically be considered for the award.
- Supporting Documents: Candidates need to submit certified copies of all relevant academic transcripts and award from all your complete or incomplete study with the evidence of your English proficiency level.
- Admission Requirements: For bachelors course equivalent of 70% or higher in Year 12 and a GPA of 5 out of 7 or 65% or higher in Undergraduate study is necessary for the master's study.
- Language Requirement: If your national language is not English, then you need to check the English language requirements of the university.

Benefits: The educational award will cover the 25% cost of the tuition fee.

Apply Online at:
http://www.canberra.edu.au/future-students/apply-now

Last Date to Apply:
10 Dec 2019

CDU GLOBAL EXCELLENCE AWARD FOR INTERNATIONAL STUDENTS IN AUSTRALIA

Offered Degree: Bachelors, Master's, MPhil

Offered Courses: Art & Design, Engineering & Technology, Business & Management, Computer Science & IT, Social Sciences, Applied & Pure Sciences, Accounting & Finance, Humanities.

- Eligible Countries: International candidates are eligible to apply.
- Acceptable Course or Subjects: Available for pursuing an undergraduate and postgraduate coursework degree program in any field at the university.
- Admissible Criteria: Participants should not hold another scholarship from an

Australian or foreign sponsorship agency.

- Not hold a current Australian Citizenship, Australian Permanent Resident or New Zealand Citizenship.

HOW TO APPLY ?

- How to Apply: The participants are advised to take admission in an undergraduate or postgraduate degree program at the university. And along with the course application form send your completed award application form.
- Supporting Documents: Candidates must have an 80-100 percentile score on the application, submit two references and a statement outlining why they should be awarded a grant.
- Language Requirement: To study at CDU, you need to satisfy all the terms and conditions of the English language.

Benefits: The educational award will cover 50% of the tuition fees for the first year of study and 10% ongoing.

For more details visit:
https://www.cdu.edu.au/international/future-students/scholarships

Last Date to Apply:
30 Nov 2019

UNIVERSITY OF WOLLONGONG INTERNATIONAL SCHOLARSHIPS, AUSTRALIA

Total value: 10% tuition fee reduction for the minimum duration of an eligible undergraduate course.

20% tuition fee reduction for the minimum duration of an eligible postgraduate course.

Citizenship requirements: Pakistani citizens

Eligibility:

Students holding Pakistani citizenship at the time of application will automatically receive the Pakistan Bursary when they choose to study one of the undergraduate or postgraduate courses commencing in 2020 and beyond.

HOW TO APPLY ?

Students who meet the eligibility criteria will be automatically considered when applying for admission to UOW. There is no separate application process.

Note: The bursary will be applied to eligible offers issued from 1 July 2019, for students commencing in 2020 and beyond.

For more Information visit:
For more details visit: https://www.uow.edu.au/study/scholarships/international/

GRIFFITH UNIVERSITY INTERNATIONAL STUDENT EXCELLENCE SCHOLARSHIP, AUSTRALIA

Undergraduate and graduate scholarships for high-achieving Nepalese or Pakistani students to study at Griffith University in Queensland, Australia.

Award value and benefits: Scholarship covers 25% of tuition fees for the duration of the program.

Applications close:

2019 commencement

- Trimester 3 2019 – Applications close Friday, 6 September 2019 (for 28 October commencement). Outcome notified by 20 September.

2020 commencement

- Trimester 1 2020 – Applications close Friday, 29 November 2019 (for 24 February commencement). Outcome notified by 13 December.
- Trimester 2 2020 – Applications close Friday, 15 May 2020 (for 6 July commencement). Outcome notified by 29 May.
- Trimester 3 2020 – Applications close Friday, 4 September 2020 (for 26 October commencement). Outcome notified by 18 September.

APPLY NOW @

https://www.griffith.edu.au/international/scholarships-finance/application-form

For more details visit: https://www.griffith.edu.au/apply/international

USAID-FUNDED SCHOLARSHIP PROGRAM

ELIGIBLITY CRITERIA

Be eligible to secure admission as per university requirements in a respective degree program covered under this scholarship scheme. Secure a new admission in an offered degree program at a participating University / Institution

HOW TO APPLY ?

- Deserving students can apply for scholarship on https://eportal.hec.gov.pk
- Application forms are also available at the respective University's Financial Aid Office.
- Completed forms along with the necessary documents will be submitted to the same Financial aid Office, HEC will NOT accept any application form directly.

SCHOLARSHIP AWARD PROCESS

- The applications of all potential candidates are reviewed by the Institutional Scholarship Award Committee (ISAC). The committee is headed by the Vice Chancellor of the participating institution, along with members from the institution as well as external members. This is done to ensure impartiality and transparency.
- The ISAC recommends potential candidates to the HEC Scholarship Management Committee (SMC). The committee includes top Executives of HEC, representatives from the participating institutions, and eminent scholars. The SMC undertakes a thorough review before approving eligible cases.
- After finalization of awardees' list, the participating institutions will forward the funds to the selected students.

For more information:

https://hec.gov.pk/english/scholarshipsgrants/USAID-NeedsBased/Pages/default.aspx
https://eportal.hec.gov.pk

PRESIDENTS SCHOLARSHIP FOR WORLD LEADERS AT UNIVERSITY OF WINNIPEG, CANADA 2019

President's Scholarship for World Leaders at University of Winnipeg in Canada, 2019 is open for International Students. The scholarship allows Bachelor, Masters level program(s) in the field of All Subjects taught at University of Winnipeg.

Eligible Countries: International Students

Institute Name: University of Winnipeg

To be Taken at (Country): Canada

Eligible Field of Study: Scholarship is available for Bachelors, Master's degree programme.

Eligibility Criteria:

- Have a minimum 80% admission average or equivalent.
- Be an International student.
- Entering first year of any programme.
- Demonstrate exceptional leadership qualities.
- Submit a complete admission application by the scholarship.

Scholarships Deadline: Sep 30, 2019

Apply now at: https://www.uwinnipeg.ca/

END OF STUDY FUNDING FOR INTERNATIONAL STUDENTS, GERMANY, 2019

Program: Masters

Fields: Art & Design, Engineering & Technology, Business & Management, Computer Science & IT, Medical & Pharmacy, Education, Social Sciences, Applied & Pure Sciences, Humanities

- **Eligible Countries:** Aspirants from any nationality
- **Acceptable Course or Subjects:** Graduate and a postgraduate degree in any subject
- **Admissible Criteria:** The applicant must be enrolled at TH Koln with the aim to obtain a university degree. They must demonstrate financial need, be in the final stage of their degree program and who, based on their previously achieved grades, are likely to graduate within a maximum of two semesters. Candidates, who live in Germany during the time of writing their final thesis, are eligible to apply.

HOW TO APPLY ?

- **How to Apply:** If you want to gain this wonderful opportunity, then you need to be registered as a bachelor or masters degree student at the university. After being admitted, candidates can download and submit the award application form to Department of International Affairs of TH Korn, Lis Dagny Ohlsen, Claudiusstr. 1, Room 55, 50678 Koln.
- **Supporting Documents:** Claimants need to attach the current certificate of enrollment at TH KOln, transcript of records with an indication of the average grade, list of not completed exams with estimated completion date, CV, recommendation letter, copy of passport with personal details, evidence of current finances, copy of the thesis registration from the examination office, and proof of social commitment.
- **Admission Requirements:** For admission, seekers must have to achieve very good or good grades in their previous studies and meet the admission requirements of the university.
- **Language Requirement:** If you want to obtain a degree at TH Koln, you need to have German language proficiency at the DSH 2 level.

Benefits

The successful scholar will get the amount worth up to 400 € per month (single parent Bachelor-students: up to 750 € / single parent Master-students: up to 850 €) for up to 6 months.

Apply Now:

https://www.th-koeln.de/en/international_office/end-of-study-scholarship_54273.php#sprungmarke_1_14

Last Date:

13 Aug 2019

RHODES SCHOLARSHIPS

Closing Date: Applications must be submitted online by 23:59 PKT, Thursday, 01 August 2019.

Nationality/citizenship: You must be a citizen of Pakistan, holding a Pakistani passport.

Education/residency: You must have undertaken formal study at an educational institution in Pakistan for a minimum of 4 of the last 10 years, and have either (i) completed a school or college leaving exam (12th standard, A-level or equivalent) at a school or college in Pakistan, or (ii) have received or would receive an undergraduate degree or mark-sheet establishing eligibility to receive an undergraduate degree at a university in Pakistan.

Age: You must have reached your 19th and not have passed your 25th birthday on 1 October 2020, which means you must have been born after 30 September 1995 and on or before 1 October 2001.

Academic Achievement: You must have completed (or will have completed by June / July 2020) an undergraduate degree from a college or university (normally a Bachelor's degree) to a sufficiently high standard to be admitted to postgraduate study at the University of Oxford (but not in any event with a GPA below 3.7). In this respect, please note carefully the requirements for your chosen course at Oxford.

HOW TO APPLY ?

a. You can apply online from 01 June 2019 at http://www.rhodeshouse.ox.ac.uk/scholarships/apply via the scholarships tab.
b. You must submit your application online, with all supporting documents, by 23:59 PKT, 01 August 2019.
c. In preparation for making your application, you should read carefully the general information, particularly that held on the Scholarships tab, on the Rhodes website, the Conditions of Tenure for the Rhodes Scholarship, the information in this document and the graduate admissions pages of the University of Oxford:
www.ox.ac.uk/admissions/graduate.
d. Shortlisted candidates will be invited to a social engagement and a final interview. You must be available to attend both, in person, as no accommodations can be made on date and time, or mode, of these events. Interviews will be held in Islamabad usually in early November. No candidate will be selected without an interview. Travel expenses will be paid by the Rhodes Trust, and will cover the round-trip cost of a First-Class rail ticket, but excluding hotel expenses. International travel for those attending from overseas cannot be funded.
e. All applicants will be emailed with the outcome of their application.

Documents and details to be submitted with application:

You must submit a completed application form on-line with copies of the documents and information detailed below.
All documents must be submitted in English, or with English translations included. Please note that, if you are invited to interview, you may be asked to bring the originals of all documents with you:

a. Your birth certificate confirming that you meet the age criterion.
b. Copy of a valid NADRA issued CNIC or passport issued by the Government of Pakistan.
c. An official transcript from the college or university at which you are studying, or have studied, showing grades achieved (to date). All evidence must be formally certified by the Registrar, or other responsible officer, of the School, College or University.

d. Copy of Matriculation Result Sheet (or equivalent i.e. Ordinary Levels Statement of Result), Higher Secondary School Result Sheet (or equivalent i.e. Advanced Levels Statement of Result), Undergraduate Result Sheet, formally certified by the School, College or University.

e. If English is not your first language, please also see the University's English language requirements: http://www.graduate.ox.ac.uk/englishproficiency.

f. A full curriculum vitae which should include details about academic qualifications, prizes, scholarships, positions of leadership, employment positions, involvement in student, voluntary, community or political activities and any cultural, musical or sporting accomplishments. This should not exceed two A4 (12pt font size) pages in length.

Please do not include a photograph in your CV.

g. A head-and-shoulders colour photograph (jpg format). Please note your photo will not be available to the selection committee until after final shortlisting decisions have been made. If you are selected, this photograph will be used on the Rhodes webpage unless or until you provide another version.

h. A personal statement of no more than 1,000 words. The personal statement is your chance to tell your story in your own voice: Who are you? What matters to you? What are you hoping to do in the world? Your academic transcript, your curriculum vitae and your reference letters will provide the substantive detail of your commitments and accomplishments, but this essay gives you the opportunity to cast the overarching narrative for the selection committee. You can find further guidance on the personal statement on the 'Application Overview' page.

i. You will need to provide a list of four people (your referees) who are willing to submit references on your behalf:

1. At least three of your referees should be academics who have formally taught and graded you in your undergraduate (or, if relevant, postgraduate) studies and who can comment in detail on your academic ability and how well they think you would fare at Oxford. Note – for successful Rhodes Scholarship applicants, these references can, in many cases, later be used to form part of the application to study at the University of Oxford, so it is important that you and your referees bear this in mind. In addition to uploading a reference, your academic referees will be asked a small number of additional questions, including to provide an estimated class ranking. See referee guidance on the final page of this document.
2. Your additional referee should testify to your character and/or your involvement in extra-curricular/service or leadership activities. These referees should be persons who are able to comment critically on whether you fulfil the extra-curricular, non-academic requirements of the Scholarship and who can speak in detail to your character.
3. A good referee is one who knows you well, rather than a well-known person who only knows you superficially. Please note that Rhodes Scholarship referees are not typically personal friends, contemporaries or relatives. If a referee fits into one of these categories, they should make the connection clear within the reference.
4. Choose reliable people who are likely to respond to your request for a detailed reference, as their letters will be crucial to your application. Insufficient references will disqualify your application from being considered by the Selection Committee.
5. You will need to provide email addresses for all of your referees.
6. Ask their permission before listing them as referees.
7. Forward to them the Guidance for Referees available on the final pages of this document. They will receive an automatically-generated email request for a reference once you have completed the referee registration section of the online form. They will also be asked to provide their business and home (or mobile) telephone, as well as their postal address for verification purposes.
8. Ensure that you register your referees within the application form early, to allow them sufficient time to provide a detailed reference letter. It is your responsibility to ensure that referees submit their references online by 23:59 PKT, 1 August 2019. Applicants can track the progress of their references within the application form.

j. Please do not upload documents, certificates, testimonials or links / URL's other than those required.

k. All applications must be submitted online. No alternate method of application is accepted. There is no application fee for submission of the Rhodes Scholarship application form.

SELECTION PROCESS ?

a. Selection for the Rhodes Scholarship is made without regard to financial means.
b. Selection for the Rhodes Scholarship is made without regard to marital status, race, ethnic origin, colour, gender, religion, sexual orientation, social background, disability, caste or other irrelevant distinction. The provision of such information in the 'Outreach' section of the application form is optional, but helps us to ensure that our selection processes are fair and that our outreach efforts are effective; those involved in selection will only see summary statistics of these responses in an anonymised format that cannot be tracked back to the individual.
c. You are applying for a Rhodes Scholarship for entry to the University of Oxford in October 2020; the scholarship cannot be deferred.
d. The Rhodes Scholarship is confirmed only upon successful admission to the University of Oxford.
e. No selection will be made if a sufficiently qualified candidate cannot be found.
f. The decision of the Selection Committee is final.

POST-SELECTION PROCESS ?

a. Please note that successful applicants will need to apply to the University of Oxford very soon after selection. Full details will be given upon selection.
b. The full application of successful candidates will be accessible to Rhodes House, Oxford, where the Scholarship references can be re-used, if appropriate, in support of the successful candidate's subsequent application to the University of Oxford.
c. Applicants invited to the final interview or newly-selected Scholars who are intending to do a second BA at Oxford can obtain an application form from the Registrar at Rhodes House (registrar@rhodeshouse.ox.ac.uk). The completed form must reach the Registrar by no later than noon GMT Friday 29 November 2019. Depending on the timing of the final Rhodes Scholarship interviews, candidates must either make a quick submission immediately following selection or they will need to submit the completed form ahead of the final interview. Candidates who are firm in their choice of a second BA may wish to maximise their chances of admittance onto the course by applying via UCAS ahead of the UCAS mid-October deadline. If you miss both the UCAS and the Rhodes deadline for the second BA application, the chances of successful admittance to the University of Oxford to study a second BA with senior status are slim.
d. Successful candidates will be encouraged to disclose, in confidence, any medical condition or special needs which may require academic or personal support in Oxford. This disclosure is entirely voluntary and is requested only to enable Rhodes House to provide suitable support in Oxford and to make the transition to Oxford as smooth as possible.

£5000 MASTER COMPARE SCHOLARSHIP IN UK FOR INTERNATIONAL STUDENTS 2019

Programs: Masters

Fields of study: Art & Design, Engineering & Technology, Business & Management, Computer Science & IT, Medical & Pharmacy, Education, Social Sciences, Applied & Pure Sciences, Accounting & Finance, Humanities.

£5000 Master Compare Scholarship in UK for International Students 2019 is open for EU, UK or International Students. The scholarship allows Masters level programm(s) in the field of All

subjects taught at UK Universities Any university in UK.

Eligible Countries: International Students

Institute Name: Any University in UK

To be Taken at (Country): UK

Eligible Field of Study: Scholarship is available for Masters Degree programme.

Scholarships Deadline: Aug 30, 2019

Apply Now at:
https://www.masterscompare.co.uk/PGscholarship/

QUEEN MARGARET UNIVERSITY (QMU) INTERNATIONAL SCHOLARSHIPS IN UK, 2020

Programs: Bachelors, Master's

Fields of Study: Art & Design, Engineering &Technology, Business & Management, Computer-Science & IT, Medical & Pharmacy, Education, Social Sciences, Applied & Pure Sciences, Architecture & Construction, Law, Accounting & Finance, Humanities.

Eligible Countries: International Students

Institute Name: Queen Margaret University (QMU)

To be taken at (country): UK

Eligible Field of Study: Scholarship is available for Bachelors, Masters degree programme.

Scholarships Deadline: Nov 30, 2019

Queen Margaret University (QM) International Scholarships in UK, 202010 open for International Students. The scholarship allows Bachelor Masters level programme(s) in the field of All Subjects taught at Queen Margaret university. The deadline is November 30, 2019

Degree Level: Bachelors, Masters Available Subject: All subjects taught in University. Scholarship Benefits: Partial Funding, £3,000

Eligible Nationalities: Open to students outside EU/CEA countries

Eligibility Criteria:

- Applied for a full-time undergraduate or postgraduate program at the University.
- Commencing their degree in Jan 2020.
- Only for self-funded students.
- Supporting statement must also include the achievements of the candidates and the description of how the scholarship

will impact them.

Apply at :
https://www.qmu.ac.uk/

VICTORIA UNIVERSITY OF WELLINGTON BARBARA FINLAYSON SCHOLARSHIP

Programs: Masters

Fields of study: Art & Design, Engineering & Technology, Business & Management, Computer Science & IT, Medical & Pharmacy, Education, Social Sciences, Applied & Pure Sciences, Architecture & Construction, Law, Accounting & Finance, Agriculture & Veterinary, Humanities.
The fund is established for New Zealand and international students to commence in the full-time postgraduate degree coursework in session 2019-2020.

Eligible Countries: International Students

Institute Name: Victoria University of Wellington

To be taken at (country): New Zealand

Eligible Field of Study: Scholarship is available for Postgraduate Degree Programme.

Scholarships Deadline: Oct 01, 2019

Apply Now at:
https://www.victoria.ac.nz/scholarships/current/barbara-finlayson-scholarship

CWF HAMILTON AND CO LTD MASTER'S SCHOLARSHIP IN MECHANICAL ENGINEERING

Programs: Masters

Fields of study: Engineering & Technology

Eligible Countries: International Students

Canterbury University (UC) is located in Christchurch, the largest city in New Zealand's South Island. The University offers a great student lifestyle with world-class research, inspiring teaching, a vibrant complex environment, and students from around the world.

To be taken at (country): The University of Canterbury, New Zealand

Eligible Field of Study: Scholarship is available for Postgraduate Degree Programme.

Scholarships Deadline: Oct 15, 2019

Apply Now at:
https://www.canterbury.ac.nz/scholarshipsearch/ScholarshipDetails.aspx?ScholarshipID=6935.147

Top Rising Organizations

NASA
(NATIONAL AERONAUTICS AND SPACE ADMINISTRATION)

The National Aeronautics and Space Administration is an independent agency of the United States Federal Government responsible for the civilian space program, as well as aeronautics and aerospace research. NASA was established in 1958, succeeding the National Advisory Committee for Aeronautics. NASA was established in 1958, succeeding the National Advisory Committee for Aeronautics (NACA). ... NASA is supporting the International Space Station and is overseeing the development of the Orion Multi-Purpose Crew Vehicle, the Space Launch System and Commercial Crew vehicles.

Headquarters: Washington, D.C., United States
Founder: Dwight D. Eisenhower
Founded: July 29, 1958, United States
Employees: 17,219 (2019)
Annual budget: 21.5 billion USD (2019)
Subsidiaries: Johnson Space Center,

NASA is uniquely positioned to combine lower Earth orbit measurements (like aircraft) and upper earth measurements (like satellites) to advance our understanding of the Earth processes. NASA operates its own aircraft and can provide the cost-savings leverages available to a large program. In addition, NASA is a major funder of Earth Science through its ROSES program, where university researchers are funded to contribute to earth sciences. In addition to a robust science program, NASA Earth Science supports fundamental services that underpin economic activities of farmers, the construction sector, and small businesses. Most people know NASA for its moon shots and participation in the International Space Station; many don't realize that NASA also supports its space mission through its Earth Science program.

MICROSOFT

Microsoft Corporation is an American multinational technology company with headquarters in Redmond, Washington. Microsoft was founded by Bill Gates and Paul Allen on April 4, 1975, to develop and sell BASIC interpreters for the Altair 8800.

Founded	April 4, 1975; 44 years ago in Albuquerque, New Mexico, U.S.
Founders	Bill Gates , Paul Allen
Headquarters	One Microsoft Way, Redmond, Washington, U.S.
Key people	John W. Thompson(Chairman) Satya Nadella(CEO) Brad Smith(President) Bill Gates(Technical Advisor)
Products	Windows ,Office Servers, Skype ,Visual Studio, Dynamics, Xbox ,Surface Mobile List of software
Services	Azure Bing LinkedIn MSDN Office 365 OneDrive Outlook.com TechNet Pay Microsoft Store Windows Update Xbox Live

It develops, manufactures, licenses, supports and sells computer software, consumer electronics, personal computers, and related services. Its best known software products are the Microsoft Windows line of operating systems, the Microsoft Office suite, and the Internet Explorer and Edge Web browsers. Its flagship hardware products are the Xbox video game consoles and the Microsoft Surface lineup of touchscreen personal computers. As of 2016, it is the world's largest software maker by revenue, and one of the world's most valuable companies.
Microsoft is ranked No. 30 in the 2018 Fortune 500 rankings of the largest United States corporations by total revenue.

APPLE

Apple Inc. is an American multinational technology company headquartered in Cupertino, California, that designs, develops, and sells consumer electronics, computer software, and online services. It is considered one of the Big Four tech companies along with Amazon, Google, and Facebook.

Founded	April 1, 1976; 43 years ago
Founders	Steve Jobs Steve Wozniak Ronald Wayne
Headquarters	1 Apple Park Way, Cupertino, California, U.S.
Number of locations	500+ retail stores (2019)
Key people	Arthur D. Levinson (Chairman) Tim Cook (CEO)

	Jeff Williams (COO)
Products	Macintosh ,iPod ,iPhone, iPad, Apple Watch, Apple TV, HomePod, macOS, iOS ,iPadOS, watchOS ,tvOS, I Life ,iWork Final Cut Pro, Logic Pro, GarageBand
Services	App Store Apple Arcade Apple Card Apple Music Beats Apple News+ Apple Pay Cash Apple Store Genius Bar Apple TV+ iBook's Store iCloud iMessage iTunes Store Mac App Store
Revenue	Increase US$265.595 billion(2018)
Net income	Increase US$59.531 billion (2018)
Number of employees	132,000 (2018)

Apple is well known for its size and revenues. Its worldwide annual revenue totaled $265 billion for the 2018 fiscal year. Apple is the world's largest technology company by revenue and one of the world's most valuable companies. It is also the world's third-largest mobile phone manufacturer after Samsung and Huawei. In August 2018, Apple became the first public U.S. company to be valued at over $1 trillion. The company employs 123,000 full-time employees and maintains 504 retail stores in 24 countries as of 2018. It operates the iTunes Store, which is the world's largest music retailer. As of January 2018, more than 1.3 billion Apple products are actively in use worldwide.

The company also has a high level of brand loyalty and is ranked as the world's most valuable brand. However, Apple receives significant criticism regarding the labor practices of its contractors, its environmental practices and unethical business practices, including anti-competitive behavior, as well as the origins of source materials.

INTEL

Intel Corporation is an American multinational corporation and technology company headquartered in Santa Clara, California, in the Silicon Valley.

Founded	July 18, 1968; 51 years ago
Founders	Gordon Moore Robert Noyce
Headquarters	Santa Clara, California, U.S.
Key people	Gordon Moore (Chairman Emeritus) Andy Bryant (Chairman) Robert H. Swan (CEO)
Products	Central processing units, Microprocessors, Integrated graphics processing units (iGPU), Systems-on-chip (SoCs), Motherboard chipsets, Network interface controllers, Modems, Mobile phones, Solid state drives , Wi-Fi and Bluetooth Chipsets, Flash memory, Vehicle automation sensors
Revenue	Increase US$70.8 billion (2018)
Net income	Increase US$21.0 billion (2018)
Number of employees	107,100

It is the world's second largest and second highest valued semiconductor chip manufacturer based on revenue after being overtaken by Samsung Electronics, and is the inventor of the x86 series of microprocessors, the processors found in most personal computers (PCs). Intel ranked No. 46 in the 2018 Fortune 500 list of the largest United States corporations by total revenue.

Intel supplies processors for computer system manufacturers such as Apple, Lenovo, HP, and Dell. Intel also manufactures motherboard chipsets, network interface controllers and integrated circuits, flash memory, graphics chips, embedded processors and other devices related to communications and computing.

SPACEX

Space Exploration Technologies Corp., doing business as SpaceX, is a private US aerospace manufacturer and space transportation services company.

Founded	May 6, 2002; 17 years ago[1]
Headquarters	Hawthorne, California, U.S.
Key people	Elon Musk (Founder, CEO and CTO) Gwynne Shotwell (President and COO)
Products	Falcon launch vehicles, Dragon capsules, Merlin, Raptor and Kestrel rocket engines, ASDS landing platforms
Services	Orbital rocket launch
Number of employees	Est. 7,000

Landmark achievements of SpaceX include

•The first privately funded liquid-fueled rocket to reach orbit (Falcon 1 flight 4 on September 28, 2008)

•The first privately developed liquid-fueled rocket to put a commercial satellite in orbit (RazakSAT on Falcon 1 flight 5 on July 14, 2009)

•The first private company to successfully launch, orbit, and recover a spacecraft (Dragon capsule on COTS demo flight 1 on December 9, 2010)

•The first private company to send a spacecraft to the International Space Station (Dragon C2+ on May 25, 2012)

•The first private company to send a satellite into geosynchronous orbit (SES-8 on Falcon 9 flight 7 on December 3, 2013)

•The first landing of an orbital rocket's first stage on land (Falcon 9 flight 20 on December 22, 2015)

•The first landing of an orbital rocket's first stage on an ocean platform (Falcon 9 flight 23 on April 8, 2016)

•The first relaunch and landing of a used orbital rocket stage (B1021 on Falcon 9 flight 32 on March 30, 2017)

•The first controlled fly back and recovery of a payload fairing (Falcon 9 flight 32 on March 30, 2017)

•The first reflight of a commercial cargo spacecraft. (Dragon C106 on CRS-11 mission on June 3, 2017)

•The first private company to send a human-rated spacecraft to space (Crew Dragon Demo-1 Mission, SpX Flight 72 on Falcon 9 flight 69 on March 2, 2019) and the first private company to autonomously dock a spacecraft to the International Space Station (same flight on March 3, 2019)