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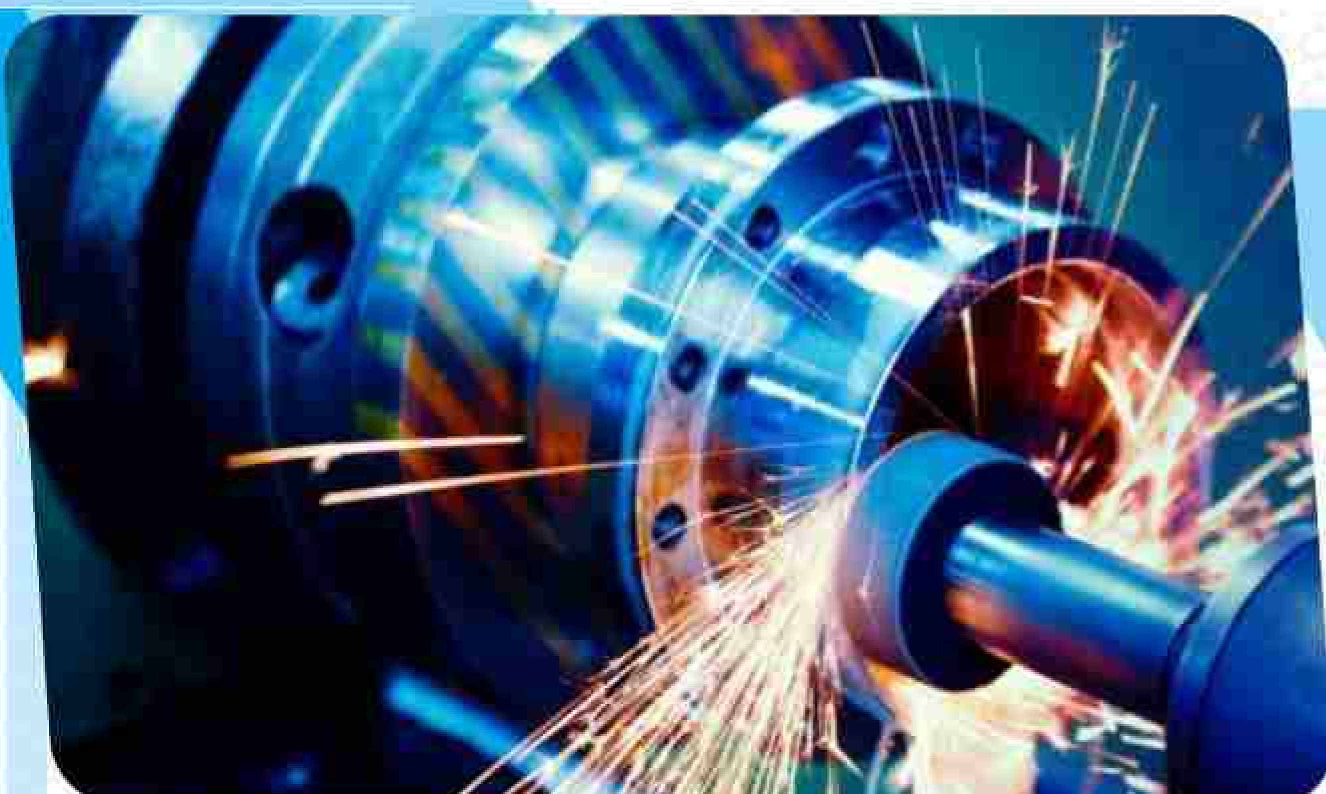
Technical Magazine

Department of Electronics and Computer Engineering



Director Message

I am very happy to know that Mechanical Engineering Department of Sharad Institute of Technology is bringing out the fifth edition of technical Magazine 'Electropages' for the year 2022- 2023. Sharad Institute of Technology has made all efforts towards the core areas of excellence in latest multidisciplinary technology with aiding efforts. I am sure that this technical magazine play important role to update students with latest technologies in the globe. Wish you all the best.

Shri. Anil Bagane
Executive Director
SITCoE, Yadrav

Principal Message

I am extremely pleasant to know that mechanical engineering department publish technical magazine 'Electropages'. I congratulate HoD, faculty and students of Electronics and Telecommunication engineering department to publish of technical magazine. I appreciate all of you for working together as a team.

I wish a very best of luck to the team of Technical Magazine.

Dr. S. A. Khot
Principal
SITCoE, Yadrav

HoD’s Message-

I feel happy to introduce issue of technical magazine prepared by students of Electronics and Telecommunication Engineering Department. We at SITCoE promise of increasing the knowledge, enhancing the critical thinking, ability to change information into knowledge and power of analyzing the things technically of each and every individual of ever changing society through students.

This magazine will reflect the intellectual as well as creative ideas of the students. Wish you all the best for Electropages team.

Dr. P. S. Patil

Head of E and TC Dept.

SITCoE, Yadrav

Editor's Message

It is my pleasure and great privilege to publish technical magazine 'Electropages'. Fifth issue of technical magazine be a snapshot of the various multidisciplinary technologies associated with Electronics and Telecommunication Engineering. We would like to place on record our gratitude and heartfelt thanks to all student and faculties from Electronics and Telecommunication department, those who have contributed to make this effort in a successful one.

We profusely thank our Hon. Executive Director Shri. Anil Bagane, Principal Dr. S. A. Khot and head of Electronics and Telecommunication engineering department Dr.P.S.Patil for giving support and encouragement and a free hand in this Endeavour.

Ms.P.D Ghate
Assistant Professor
Electronics and
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5G Wireless Technology

The search engine major Google has already confirmed that the smartphone user base has surpassed the desktop user base. If we go back a few years, the maximum RAM in a smartphone was in a few MB's only but now, even the smartphone configurations are competing with personal computers. It is evident that smartphone usage without the internet is barely minimum. With the increased dependency on IoT, internet speed plays a pivotal role.

He majority of companies think of future needs, innovations, services that could give a better life to mankind. Keeping this in mind, 5G thoughts were rolled a decade back even before the 4G technology was in place. Of course, the 4G has been a base to implement 5G. We will discuss countrywide 5G roll out further in this article.

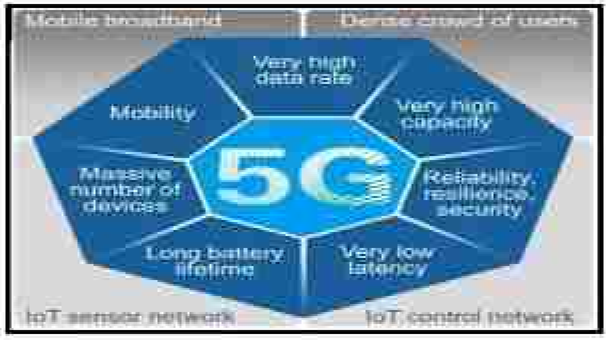
5G simply refers to the next and newest mobile wireless standard based on the IEEE 802.11ac standard of broadband technology.

Rather than faster Internet connection speeds, 5G aims at a higher capacity than current 4G LTE, allowing a higher number of mobile broadband users per area unit, and allowing consumption of data quantities in gigabyte per second. This would make it feasible for a large portion of the population to consume high-quality streaming media many hours per day on their mobile devices, also when out of reach of wi fi hot spots. 5G research and development also aim at the improved support of machine to machine communication, also known as the Internet of things, aiming at a lower cost, lower battery consumption, and lower latency and to increase the security and connectivity for a large community.

The following are the key takeaways of the 5G network:

- High & increased peak bit rate (Up to 10Gbps connections to endpoints in the field)
- Larger data volume per unit area (i.e. high system spectral efficiency)
- High capacity to allow more devices connectivity concurrently and instantaneously (100 percent coverage)
- More bandwidth
- Peak rate of 10 Gb/s
- Lower battery consumption

- Better connectivity irrespective of the geographic region where you are in
- A larger number of supporting devices (10 to 100x number of connected devices)
- Lower cost of infrastructural development



The most distinguishing feature of 5G Network is that the network will be based on User experience, System Performance, enhanced performance, business models, and Management & Operations. 5G will utilize advanced access technologies such as Beam Division Multiple Access (BDMA) and Non and quasi-orthogonal or Filter Bank Multi carrier (FBMC) Multiple Access. The new advanced technology called Fog Computing is going to support the 5G development, this will help in achieving low latency, high mobility, high scalability, and real-time execution. Follow the link to read about the Applications of 5G in detail.

How does 5G work?

In 5G, the network service area is divided into small geographical areas called cells. All the 5G wireless devices in a cell communicate by radio waves with a local antenna and low-power automated transceiver (transmitter and receiver) in the cell. The local antennas are connected to the telephone network and the Internet by a high-bandwidth optical fiber or wireless back haul connection. The new 5G wireless devices include 4G LTE support as well to establish a connection with the cell and to connect to the internet at locations where 5G access is not available. 5G can support up to a million devices per square kilometer, while 4G supports only up to 100,000 devices per square kilometer.

5G operates on 3 different spectrum bands.

1. Low-band spectrum – Expect peak speeds up to 100Mbps
2. mid-band spectrum – Expect peak speeds up to 1Gbps
3. high-band spectrum – Expect peak speeds up to 10Gbps

Snehal Kumar Dattawade (Btech)
Swarupa Rakesh Patil (BTech)

6G NETWORK

In tel-communications 6G is the sixth Generation mobile system standard currently under development for wireless communications technologies supporting cellular data networks. It is the planned successor to 5G and will likely be significantly faster. Like its predecessors, 6G networks will probably be broadband cellular networks, in which the service area is divided into small geographical areas called cells. Several companies (Airtel, Anritsu, Apple, Ericsson, Fly, Huawei, Jio, Keysight, LG, Nokia, NTT Docomo, Samsung, Vi, Xiaomi), research institutes (Technology Innovation Institute, the Interuniversity Microelectronics Centre) and countries (United States, countries in the European Union, Russia, China, India, Japan, South Korea, Singapore and United Arab Emirates) have shown interest in 6G networks.

6G networks are expected to be even more diverse than their predecessors and are likely to support applications beyond current mobile use scenarios, such as virtual and augmented reality (VR/AR), ubiquitous instant communications, pervasive intelligence and the Internet of Things (IoT).[11] It is expected that mobile network operators will adopt flexible decentralized business models for 6G, with local spectrum licensing, spectrum sharing, infrastructure sharing, and intelligent automated management underpinned by mobile edge computing, artificial intelligence (AI), short-packet communication and blockchain technologies.

Expectation

Recent academic articles have been conceptualizing 6G and new features that may be included. AI is included in many of these predictions, from 6G supporting AI infrastructure to "AI designing and optimizing 6G architectures, protocols, and operations. Another study in Nature Electronics looks to provide a framework for 6G research stating "We suggest that human-centric mobile communications will still be the most important application of 6G and the 6G network should be human-centric. Thus, high security, secrecy and privacy should be key features of 6G and should be given particular attention by the wireless research community."

The question of what frequencies 6G will operate on are still up to interpretation. The Institute of Electrical and Electronics Engineers states that "Frequencies from 100 GHz to 3 THz are promising bands for the next generation of wireless communication systems because of the wide swaths of unused and unexplored spectrum." One of the biggest challenges in supporting the required high transmission speeds will be the limitation of energy/power consumption and associated heat development in the electronic circuits to acceptable proportions.

A book published by Wiley (IEEE series) in December 2021 provides a snapshot of current international thinking on the major 6G research aspects. It states "Besides technologies and services, the business models of mobile communication networks are also evolving and will continue to evolve rapidly in the forthcoming years. Due to the ongoing fixed-mobile network convergence and ICT convergence, future communications will be tightly integrated in enterprise applications. The global rise of 5G campus networks should be considered just the start toward 5G enterprise networking and the emergence of new business models and ecosystems. This also raises questions on the role of international standards and rise of open software stacks paving the way toward a new telecommunications ecosystem, in which virtualized network functions from different developers and providers can be dynamically orchestrated and integrated in a secure, reliable, and energy-efficient manner. On November 6, 2020, China successfully launched an experimental test satellite with candidates for 6G technology into orbh 12 other satellites, using a Long March 6 launch vehicle rocket. The satellite

Tejaswini Telvekar, Neha Mane.

TREE PLANTATION ON SPACE

The growth of plants in outer space has elicited much scientific interest.In the late 20th and early 21st century, plants were often taken into space in low Earth orbit to be grown in a weightless but pressurized controlled environment, sometimes called space gardens. In the context of human spaceflight, they can be consumed as food and/or provide a refreshing atmosphere. Plants can metabolize carbon dioxide in the air to produce valuable oxygen, and can help control cabin humidity .Growing plants in space may provide a psychological benefit to human spaceflight crews. Usually the plants were part of studies or technical development to further develop space gardens or conduct science experiments.To date plants taken into space have had mostly scientific interest, with only limited contributions to the functionality of the spacecraft, however the Apollo Moon tree project was more or less forestry inspired mission and the trees part of a country's bicentennial celebration.

The first challenge in growing plants in space is how to get plants to grow without gravity.This runs into difficulties regarding the effects of gravity on root development, providing appropriate types of lighting, and other challenges. In particular, the nutrient supply to root as well as the nutrient biogeochemical cycles, and the microbiological interactions in soil-based substrates are particularly complex, but have been shown to make possible space farming in hypo- and micro-gravity.

NASA plans to grow plants in space to help feed astronauts, and to provide psychological benefits for long-term space flight. In 2017, aboard ISS in one plant growth device, the 5th crop of Chinese cabbage (*Brassica rapa*) from it included an allotment for crew consumption, while the rest was saved for study. An early discussion of plants in space, were the trees on the brick moon space station, in the 1869 short story "The Brick Moon".

Zinnia plant in bloom aboard an Earth orbiting space station

History:

In the 2010s there was an increased desire for long-term space missions, which led to desire for space-based plant production as food for astronauts. An example of this is vegetable production on the International Space Station in Earth orbit. By the year 2010, 20 plant growth experiments had been conducted aboard the International Space Station.

Several experiments have been focused on how plant growth and distribution compares in micro-gravity, space conditions versus Earth conditions. This enables scientists to explore whether certain plant growth patterns are innate or environmentally driven. For instance, Allan H. Brown tested seedling movements aboard the Space Shuttle Columbia in 1983. Sunflower seedling movements were recorded while in orbit. They observed that the seedlings still experienced rotational growth and circumnation despite lack of gravity, showing these behaviors are instinctual.

Other experiments have found that plants have the ability to exhibit gravitropism, even in low-gravity conditions. For instance, the ESA's European Modular Cultivation System enables experimentation with plant growth; acting as a miniature greenhouse, scientists aboard the International Space Station can investigate how plants react in variable-gravity conditions. The Gravi-1 experiment (2008) utilized the EMCS to study lentil seedling growth and amyloplast movement on the calcium-dependent pathways. The results of this experiment found that the plants were able to sense the direction of gravity even at very low levels. A later experiment with the EMCS placed 768 lentil seedlings in a centrifuge to stimulate various gravitational changes; this experiment, Gravi-2 (2014), displayed that plants change calcium signalling towards root growth while being grown in several gravity levels.

Many experiments have a more generalized approach in observing overall plant growth patterns as opposed to one specific growth behavior. One such experiment from the Canadian Space Agency, for example, found that white spruce seedlings grew differently in the anti-gravity space environment compared with Earth-bound seedlings; the space seedlings exhibited enhanced growth from the shoots and needles, and also had randomized amyloplast distribution compared with the Earth-bound control group.

Food production is key to making Space exploration feasible. Currently, the cost of sending food to the International Space Station (ISS) is estimated as USD\$20 000–40 000/kg, with each crew member receiving ~1.8 kg of food (plus packaging) per day. Re-stocking from Earth, a lunar orbiting Space station or Mars habitation with food will be significantly more costly. The first trips to Mars are expected to be a three-year round trip, and it has been estimated that a four-person crew would need 10–11 000 kgs of food.

Vegetable Production System for ISS being discussed

Early effort

The first organisms in space were "specially developed strains of seeds" launched to 134 km (83 mi) on 9 July 1946 on a U.S. launched V-2 rocket. These samples were not recovered. The first seeds launched into space and successfully recovered were maize seeds launched on 30 July 1946. Soon followed rye and cotton. These early suborbital biological experiments were handled by Harvard University and the Naval Research Laboratory and were concerned with radiation exposure on living tissue. On September 22 1966, Kosmos 110 launched with two dogs and moisturized seeds. Several of those seeds germinated, the first to do so, resulting in lettuce, cabbage and some beans that had greater yield than their controls on Earth. In 1971, 500 tree seeds (Loblolly pine, Sycamore, Sweetgum, Redwood, and Douglas fir) were flown around the Moon on Apollo 14. These Moon trees were planted and grown with controls back on Earth where no changes were detected.

Space station era

In 1982, the crew of the Soviet Salyut 7 space station conducted an experiment, prepared by Lithuanian scientists (Alfonsas Merkys and others), and grew some Arabidopsis using Fiton-3 experimental micro-greenhouse apparatus, thus becoming the first plants to flower and produce seeds in space. A Skylab experiment studied the effects of gravity and light
on rice plants. The SVET-2 Space Greenhouse successfully achieved seed to seed plant growth in 1997 aboard space station Mir. Bion 5 carried Daucus carota and Bion 7 carried maize (aka corn).

Plant research continued on the International Space Station. Biomass Production System was used on the ISS Expedition 4. The Vegetable Production System (Veggie) system was later used aboard ISS. Plants tested in Veggie before going into space included lettuce, Swiss chard, radishes, Chinese cabbage and peas. Red Romaine lettuce was grown in space on Expedition 40 which were harvested when mature, frozen and tested back on Earth. Expedition 44 members became the first American astronauts to eat plants grown in space on 10 August 2015, when their crop of Red Romaine was harvested. Since 2003 Russian cosmonauts have been eating half of their crop while the other half goes towards further research. In 2012, a sunflower bloomed aboard the ISS under the care of NASA astronaut Donald Pettit. In January 2016, US astronauts announced that a zinnia had blossomed aboard the ISS.

In 2017 the *Advanced Plant Habitat* was designed for ISS, which was a nearly self-sustaining plant growth system for that space station in low Earth orbit. The system is installed in parallel with another plant grown system aboard the station, VEGGIE, and a major difference with that system is that APH is designed to need less upkeep by humans. APH is supported by the *Plant Habitat Avionics Real-Time Manager*. Some plants that were to be tested in APH include Dwarf Wheat and Arabidopsis. In December 2017 hundreds of seeds were delivered to ISS for growth in the VEGGIE system.

In 2018 the Veggie-3 experiment at the ISS, was tested with plant pillows and root mats. One of the goals is to grow food for crew consumption. Crops tested at this time include cabbage, lettuce, and mizuna. In 2018, the PONDS system for nutrient deliver in microgravity was tested.

The arugula-like lettuce Mizuna growing for Veg-03 A young sunflower plant aboard the ISS

In 2018 the Veggie-3 experiment at the ISS, was tested with plant pillows and root mats. One of the goals is to grow food for crew consumption. Crops tested at this time include cabbage, lettuce, and mizuna. In 2018, the PONDS system for nutrient deliver in microgravity was tested.

Interior view of a hypothetical O'Neill cylinder space habitat, showing alternating land and window stripes.

In December 2018, the German Aerospace Center launched the EuCROPIS satellite into low Earth orbit. This mission carries two greenhouses intended to grow tomatoes under simulated gravity of first the Moon and then Mars (6 months each) using by-products of human presence in space as source of nutrients.

The Seedling Growth series of experiments to study the mechanisms of tropisms and the cell/cycle were performed on the ISS between 2013 and 2017. These experiments also involved using the model plant Arabidopsis thaliana, and were a collaboration between NASA (John Z. Kiss as PI) and ESA (F. Javier Medina as PI).

On 30 November 2020, astronauts aboard the ISS collected the first harvest of radishes grown on the station. A total of 20 plants was collected and prepared for transportation back to Earth. There are currently plans to repeat the experiment and grow a second batch.

Lunar surface - from 2019

Chang'e 4 lunar lander in January 2019, carried a 3 kg (6.6 lb) sealed "biosphere" with many seeds and insect eggs to test whether plants and insects could hatch and grow together in synergy. The experiment included seeds of potatoes, tomatoes, and Arabidopsis thaliana (a flowering plant), as well as silkworm eggs. These became the first plants grown on the Moon. Environmental systems will keep the container hospitable and Earth-like, except for the low lunar gravity. If the eggs hatch, the larvae would produce carbon dioxide, while the germinated plants would release oxygen through photosynthesis. It is hoped that together, the plants and silkworms can establish a simple synergy within the container. A miniature camera will photograph any growth. The biological experiment was designed by 28 Chinese universities.

Plants grown in space

Lettuce grown in space aboard the ISS

Plants grown in space include:

- Arabidopsis (Thale cress)
- Bok choy (Tokyo Bekana) (Chinese cabbage)
- Super dwarf wheat
- Apogey wheat
- Brassica rapa
- Rice
- Tulips
- Kalanchoe
- Flax
- Onions, peas, radishes, lettuce, wheat, garlic, cucumbers, parsley, potato, and dill
- Lettuce and Cinnamon basil
- Cabbage
- Zinnia hybrida ("Profusion" var.)
- Mizuna lettuce
- Red romaine lettuce ("Outredgeous" var.)
- Sunflower
- *Ceratopteris richardii*

Experiments

Illustration of plants growing in a hypothetical Mars base.

Some experiments involving plants include:

- Advanced Plant Habitat, began April 2017 aboard the ISS.
- Bion satellites, began 1973.
- Biomass Production System, began April 2002, aboard the ISS.
- Vegetable Production System (Veggie), began May 2014 aboard the ISS.
- SVET, began June 1990 aboard Mir.
- SVET-2, was conducted in 1997 aboard Mir.
- Lada greenhouse (aka Lada Validating Vegetable Production Unit), began 2002, aboard the ISS
- ADVASC, aboard the ISS and Mir.
- TAGES, began November 2009 aboard the ISS.
- Plant Growth/Plant Phototropism, selected March 1972 aboard Skylab.
- Oasis plant growth unit, began 1971 aboard the Salyut 1.
- Plant Signaling (STS-135), began July 2011 aboard the ISS.
- Plant growth experiment (STS-95), began October 1998 aboard the ISS.
- NASA Clean Air Study, began in 1989 at the Stennis Space Center.
- ECOSTRESS, began June 2018 aboard the ISS.
- Chang'e 4 lunar lander "biosphere" with seeds and insect eggs to test whether plants and insects could hatch and grow together in synergy, began 2019.

- SpaceMoss (SpaceX CRS-18), a NASA experiment studying the growth of the moss Physcomitrella patens in microgravity, began July 2019 aboard the ISS.
- Algae as sustainable food in space·e to be developed and released by 2030.

Test satellite launch

On November 6, 2020, China successfully launched an experimental test satellite with candidates for 6G technology into orbit, along with 12 other satellites, using a Long March 6 launch vehicle rocket. The satellite is intended to "verify the terahertz (THz) communication technology in space", according to the Global Times newspaper.

6G networks are expected to be developed and released by 2030.

The Future is Here: Exploring the Exciting Possibilities of 6G Technology

The world of technology has evolved rapidly over the past few decades, and it seems like the next big thing is already on the horizon. 6G technology promises to revolutionize the way we use our devices and connect with the world around us. With speeds that are 100 times faster than 5G, 6G is set to bring a new level of connectivity that we've never seen before. In this article, we'll explore the exciting possibilities of 6G technology.

6G technology is the next generation of mobile networks that promises to be faster, more efficient, and more reliable than any other network before it. It is expected to have speeds of up to 100 times faster than 5G, making it possible for us to download movies in mere seconds and stream high-quality videos without any buffering. But it's not just about speed; 6G will also have the ability to connect billions of devices seamlessly and enable technologies like augmented reality, virtual reality, and the Internet of Things to flourish. In this article, we'll take a closer look at the work that's being done in the field of 6G technology, the solutions it offers, and the problems that need to be addressed.

6G technology is still in its early stages, and researchers are working hard to bring it to life. One of the main goals of 6G is to increase network efficiency by reducing latency and improving energy consumption. To achieve this, researchers are exploring new technologies like terahertz frequency bands, massive MIMO (multiple-input, multiple-output), and AI-driven network management. They are also exploring the use of satellite communications and quantum cryptography to improve network security and reliability.

The solutions that 6G technology offers are vast and far-reaching. With its ability to connect billions of devices and provide lightning-fast speeds, 6G will enable technologies like autonomous vehicles, smart cities, and remote surgeries to become a reality. However, there are also some challenges that need to be addressed. One of the biggest concerns is the potential health risks associated with increased exposure to radiofrequency radiation. There are also concerns about the environmental impact of the massive infrastructure required for 6G networks.

Reference:

-What is 6G? by TechRadar

-The Potential of 6G Technology" by Forbes

Abhishek Ravindra Jagdale

Omkar Shivaji Jadhav

Smart Hybrid Aquaponics E-Control System For Agriculture Farm Field

Aquaponics is a form of food production that blends traditional hydroponics with aquaculture in a symbiotic relationship that permits a sustainable system with necessary input since all of the water and nutrients within are re-circulated in order to develop both terrestrial plants and aquatic life. If used well, this agricultural technology might take the place of other conventional ones. Additionally when the technology and conventional aquaponics are combined, then extraordinary results may be seen. The IoT-based Aquaponics controlling and Monitoring system has features to track ECpH value, temperature and humidity level, and water level using specific sensors. The values were then displayed through a 16*2 Liquid Crystal Display and on the web by the use of the Internet of Things.

The term "Aquaponics" describes a technique that combines Aquaculture (the rearing of fish) and the Hydroponics system (the cultivation of the plants without soil).

In hydroponics, water must be added with adequate nutrients for the plants, and in aquaculture, ammonia present in the water must be treated constantly which is from fish waste.

In aquaponics, the plants oxygenate the water for wish and the bacteria convert the ammonia from fish waste to nitrates which serve as nutrients for growing plants. The nitrifying bacteria transform the ammonia-containing fish excretions into nitrites, which are then transformed to nitrates, which can be used as plant nutrients.

Aquaponics system is the more advantageous than the traditional farming techniques in areas lacking in fertile soil, water, or even open space for farming.

The major goal of this aquaponics system is to create an IoT based aquaponics monitoring and controlling system that continuously measures and shows users metrics like ECpH level, water level, humidity and temperature, turbidity, etc. The hardware elements that are sensors

The phrase "Aquaponics" refers to a method that combines the hydroponics, which is the growing of plants without soil, with aquaculture, the rearing of fish. The fish excretions that are rich in ammonia are converted by the nitrifying bacteria into nitrites and nitrates, which can be used as plant fertilisers. Where there isn't enough water, good soil, or even space for farming, aquaponics is more advantages than the conventional farming and methods. The primary objective of this aquaponics system is to develop an Internet of Things (IoT)-based on the aquaponics monitoring system that continuously measures and displays to users parameters like ECpH level, water level, humidity, temperature, turbidity, etc. The hardware components that include the sensors.

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Sayali Rajgonda Raynade.

Harshada Himmat Wani.

(TY B ETC)

Internet of Things

What is IOT:-

IoT stands for Internet of Things. It refers to the interconnectedness of physical devices, such as appliances and vehicles, that are embedded with software, sensors, and connectivity which enables these objects to connect and exchange data. This technology allows for the collection and sharing of data from a vast network of devices, creating opportunities for more efficient and automated systems.

Internet of Things (IoT) is the networking of physical objects that contain electronics embedded within their architecture in order to communicate and sense interactions amongst each other or with respect to the external environment. In the upcoming years, IoT-based technology will offer advanced levels of services and practically change the way people lead their daily lives. Advancements in medicine, power, gene therapies, agriculture, smart cities, and smart homes are just a very few of the categorical examples where IoT is strongly established.

Advantages of IoT :

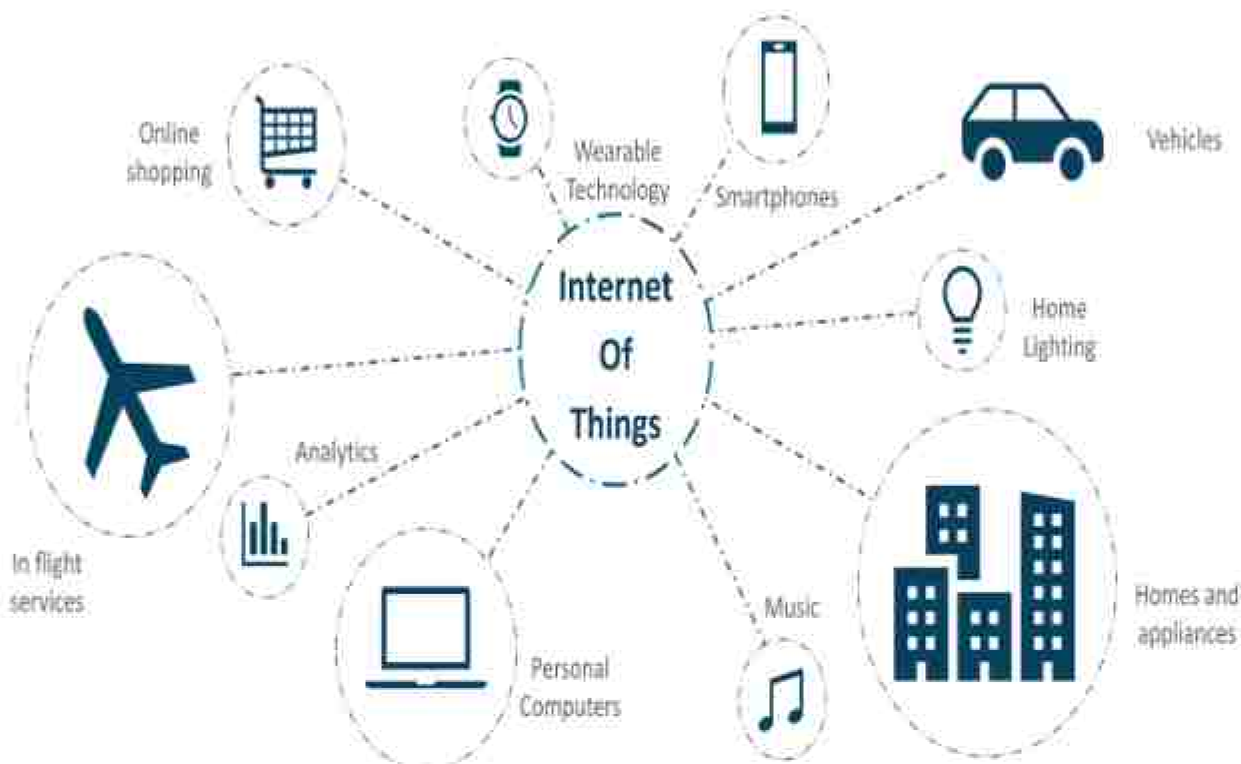
1. Improved efficiency and automation of tasks.
2. Increased convenience and accessibility of information.
3. Better monitoring and control of devices and systems.
4. Greater ability to gather and analyze data.
5. Improved decision-making.
6. Cost savings.

What are some IoT applications?

Looking at IoT applications, which are sometimes described as use cases, can help ground the discussion about what IoT is. Broadly, IoT applications occur in one of nine settings.

1. *Human health.* Devices can be attached to or inserted inside the human body, including wearable or ingestible devices that monitor or maintain health and wellness, assist in managing diseases such as diabetes, and more.
2. *Home.* Homeowners can install devices such as home voice assistants, automated vacuums, or security systems.
3. *Retail environments.* Devices can be installed in stores, banks, restaurants, and arenas to facilitate self-checkout, extend in-store offers, or help optimize inventory.

4. *Offices.* IoT applications in offices could entail energy management or security for buildings.
5. *Standardized production environments.* In such settings, including manufacturing plants, hospitals, or farms, IoT applications often aim to gain operating efficiencies or optimize equipment use and inventory.
6. *Custom production environments.* In customized settings like those in mining, construction, or oil and gas exploration and production, IoT applications might be used in predictive maintenance or health and safety efforts.
7. *Vehicles.* IoT can help with condition-based maintenance, usage-based design, or presales analytics for cars and trucks, ships, airplanes, and trains.
8. *Cities.* IoT applications can be used for adaptive traffic control, smart meters, environmental monitoring, or managing resources.
9. *Outside.* In urban environments or other outdoor settings, such as railroad tracks, autonomous vehicles, or flight navigation, IoT applications could involve real-time routing, connected navigation, or shipment tracking.



Why do we need Internet of Things (IoT)?

Have you ever been in a situation where you went to the market and forgot to switch off your AC, fan, or light and felt helpless that you cannot return home to switch it off? This is where IoT comes into the picture. It can remind you of the essential tasks that you often forget to do. Also, using the mobile application, you can access your home appliances integrated with IoT from anywhere around the world.Another very exciting IoT device is the NFC (near field communication) smart ring.

Future Scope of IoT

Internet of Things has emerged as a leading technology around the world. It has gained a lot of popularity in lesser time. Also, the advancements in Artificial Intelligence and Machine Learning have made the automation of IoT devices easy. Basically, AI and ML programs are combined with IoT devices to give them proper automation. Due to this, IoT has also expanded its area of application in various sectors. Here, in this section, we will discuss the applications and the future scope of IoT in healthcare, automotive, and agriculture industries.

Priyanka Pndurang Ingavale

Srushti Ajit patil

TY, E&TC

Cloud Computing

INTRODUCTION

Like real clouds which are the collection of water molecules, the term cloud in cloud computing is the collection of networks. The user can use the modalities of cloud computing boundlessly whenever demanded. Instead of setting up their own physical infrastructure, the users ordinarily prefer a mediator provider for the service of the internet in cloud computing. The users have to pay only for the services they had used [2]. The workload can be shifted to reduce the workload in cloud computing. A load of service is handled by the networks which forms the cloud that's why the load on local computers is not heavy while running an application [1]. So the requisition of hardware and software at the user side is decreased. All we need to have a web browser to use cloud computing. All we need to have a web browser like chrome to use cloud computing. Following are the key features of cloud computing. I.I Resource Pooling and Elasticity I.II Self-Service and On-Demand Services I.III Pricing I.IV Quality of Service There are three services provided by cloud computing that are Software as a Service Platform as a Service and

Infrastructure as a Service . The basic examples of cloud computing which are used by general people in daily life are , YouTube, Dropbox, and Gmail etc. It offers scalability, flexibility, agility, and simplicity that's why its use is rapidly increasing in the enterprises.

TYPES OF CLOUD COMPUTING

I. **Public Cloud**: The public cloud is a computing service supplied by the third party providers atop the public internet [6]. These services are available for any user who wants to use them and they have to pay only for the services they consumed.

II. **Private Cloud:** The computing services provided over the internet or private network come under the private cloud and these services are offered only to the selected users in place of common people [1,6]. A higher security and privacy is delegated by private clouds through the firewall and internal hosting.

III. **Hybrid Cloud:** Hybrid cloud is the combination of public cloud and private cloud. In the hybrid cloud, each cloud can be managed independently but data and applications can be shared among the clouds in the hybrid cloud

BENEFITS OF CLOUD COMPUTING

Cost Saving: In cloud computing users have to only pay for the services they consumed. Maintenance cost is low as user do not need to purchase the infrastructure [2].

Flexibility: Cloud computing is scalable. The rapid scale up and down in the operations of your business may require quick adjustment of hardware and resources so in order to manage this variations cloud computing provide flexibility.

Enhanced Security: Cloud computing provide high security by using the data encryption, strong access controls, key management, and security intelligence.

Disha Kiran Shinde

Saniya Salim Mujawar

(E&TC TY B)

Combatting pollution

Pollution control is the process of reducing or eliminating the release of harmful substances into the environment. With the increasing industrialization and urbanization, pollution has become a major problem that has adverse effects on our health and the environment.

To tackle pollution, it is important to understand its sources. Pollution can come from various sources such as industries, transportation, agriculture, and even households. Some of the common pollutants include carbon monoxide, sulphur dioxide, nitrogen oxides, and particulate matter. These pollutants can lead to respiratory problems, cardiovascular diseases, and even cancer.

To control pollution, it is essential to adopt a multi-pronged approach. One of the key strategies is to reduce emissions from various sources. Industries can adopt cleaner technologies, and transportation can shift towards electric vehicles and public transport. Households can reduce their carbon footprint by adopting sustainable practices such as recycling, using energy-efficient appliances, and reducing water usage.

Another important aspect of pollution control is monitoring. Regular monitoring of air, water, and soil quality can help identify sources of pollution and take necessary actions to reduce them. Governments can also introduce regulations and policies to control pollution, such as setting emission standards and imposing fines on violators.

In addition to reducing emissions, there are also several methods of cleaning up pollution. For example, wastewater treatment plants can remove pollutants from wastewater before it is discharged into rivers or oceans. Bioremediation is another method where microorganisms are used to break down pollutants into harmless substances.

In conclusion, pollution control is a complex issue that requires a multifaceted approach. It is essential for governments, industries, and individuals to work together to reduce emissions, monitor pollution levels, and clean up the environment. By adopting sustainable practices and technologies, we can ensure a cleaner and healthier future for ourselves and the planet.

Pollution is a major issue that affects our planet in various ways, from damaging the environment to harming wildlife and human health. With the right strategies and collective efforts, we can combat pollution and work towards a cleaner, greener future.

One of the most effective ways to combat pollution is to reduce the amount of waste that we generate. This can be achieved by recycling and properly disposing of waste materials. Recycling not only helps reduce the amount of waste that goes into landfills but also conserves natural resources by reducing the need for new materials. Proper disposal of waste also ensures that hazardous materials do not end up polluting the environment.

Another important step in combating pollution is to promote the use of renewable energy sources, such as solar and wind power. This can help reduce our reliance on fossil fuels, which are a major source of pollution. Investing in clean energy technology can also create new jobs and spur economic growth while reducing our carbon footprint.

Additionally, transportation is a significant contributor to pollution, and reducing our reliance on cars can help combat pollution. We can do this by promoting the use of public transportation, carpooling, cycling, and walking. Electric cars are also an excellent alternative to traditional vehicles, as they produce zero emissions.

It's also crucial to take steps to prevent pollution before it happens. This can be done through the use of sustainable farming practices, reducing chemical usage, and promoting eco-friendly manufacturing processes. Proper urban planning and development can also help reduce pollution by promoting green spaces and reducing the use of harmful materials.

Lastly, we can all play a part in combatting pollution by making small but impactful changes in our daily lives. This can include reducing our consumption of single-use plastics, conserving energy and water, and supporting businesses that prioritize sustainability.

Reduce waste: One of the most effective ways to combat pollution is to reduce the amount of waste that we produce. This can be achieved by practicing the three Rs - reduce, reuse, and recycle. By reducing the amount of waste we generate, we can significantly decrease the amount of pollution that ends up in landfills and other areas.

Use clean energy: Another way to combat pollution is to use clean, renewable energy sources such as solar, wind, and hydroelectric power. By using renewable energy sources, we can reduce our reliance on fossil fuels, which are a major source of pollution.

Encourage sustainable transportation: Transportation is a significant contributor to pollution. Encouraging sustainable modes of transportation such as walking,

Artificial intelligence (AI)

Artificial intelligence (AI) is intelligence—perceiving, synthesizing, and inferring information—demonstrated by machines, as opposed to intelligence displayed by non-human animals or by humans. Example tasks in which this is done include speech recognition, computer vision, translation between (natural) languages, as well as other mappings of inputs.

AI applications include advanced web search engines (e.g., Google Search), recommendation systems (used by YouTube, Amazon, and Netflix), understanding human speech (such as Siri and Alexa), self-driving cars (e.g., Waymo), generative or creative tools (ChatGPT and AI art), automated decision-making, and competing at the highest level in strategic game systems (such as chess and Go).

As machines become increasingly capable, tasks considered to require "intelligence" are often removed from the definition of AI, a phenomenon known as the AI effect.

Artificial intelligence was founded as an academic discipline in 1956, and in the years since it has experienced several waves of optimism, followed by disappointment and the loss of funding (known as an "AI winter"), followed by new approaches, success, and renewed funding.[5][8] AI research has tried and discarded many different approaches, including simulating the brain, modeling human problem solving, formal logic, large databases of knowledge, and imitating animal behavior. In the first decades of the 21st century, highly mathematical and statistical machine learning has dominated the field, and this technique has proved highly successful, helping to solve many challenging problems throughout industry and academia.

The various sub-fields of AI research are centered around particular goals and the use of particular tools. The traditional goals of AI research include reasoning, knowledge representation, planning, learning, natural language processing, perception, and the ability to move and manipulate objects. General intelligence (the ability to solve an arbitrary problem) is among the field's long-term goals. To solve these problems, AI researchers have adapted and integrated a wide range of problem-solving techniques, including search and mathematical optimization, formal logic, artificial neural networks, and methods based on statistics, probability, and economics. AI also draws upon computer science, psychology, linguistics, philosophy, and many other fields.

The field was founded on the assumption that human intelligence "can be so precisely described that a machine can be made to simulate it". This raised philosophical arguments about the mind and the ethical consequences of creating artificial beings endowed with human-like intelligence; these issues have previously been explored by myth, fiction, and philosophy since antiquity. Computer scientists and philosophers have since suggested that AI may become an existential risk to humanity if its rational capacities are not steered towards beneficial goals. The term artificial intelligence has also been criticized for over hyping AI's true technological capabilities.

Artificial Intelligence for Wireless Communications and Control Networks

Artificial intelligence (AI), the ability of a digital computer or computer-controlled robot to perform tasks commonly associated with intelligent beings. The term is frequently applied to the project of developing systems endowed with the intellectual processes characteristic of humans, such as the ability to reason, discover meaning, generalize, or learn from past experience. Since the development of the digital computer in the 1940s, it has been demonstrated that computers can be programmed to carry out very complex tasks—as, for example, discovering proofs for mathematical theorems or playing chess—with great proficiency. Still, despite continuing advances in computer processing speed and memory capacity, there are as yet no programs that can match human flexibility over wider domains or in tasks requiring much everyday knowledge. On the other hand, some programs have attained the performance levels of human experts and professionals in performing certain specific tasks, so that artificial intelligence in this limited sense is found in applications as diverse as medical diagnosis, computer search engines, and voice or handwriting recognition.

All but the simplest human behaviour is ascribed to intelligence, while even the most complicated insect behaviour is never taken as an indication of intelligence. What is the difference? Consider the behaviour of the digger wasp, *Sphex ichneumoneus*. When the female wasp returns to her burrow with food, she first deposits it on the threshold, checks for intruders inside her burrow, and only then, if the coast is clear, carries her food inside. The real nature of the wasp's instinctual behaviour is revealed if the food is moved a few inches away from the entrance to her burrow while she is inside: on emerging, she will repeat the whole procedure as often as the food is displaced. Intelligence—conspicuously absent in the case of *Sphex*—must include the ability to adapt to new circumstances.

The fifth generation (5G) of wireless networks is currently being deployed. Both industry and academia have started to look beyond the 5G, with the aim to increase the networks' capabilities to serve a massive amount of diversified mobile applications, especially those supported by artificial intelligence, such as intelligent industry and self-driving vehicles.

The performance of such application depends on the intelligent trade-off among computational accuracy, latency, and efficient use of available resources. From this perspective, the wireless networks beyond the 5G are envisioned to significantly extend wireless network depth from single information transmission to intelligent information transmission, storage, and processing, which will maximize the overall performance and quality of experience for various services and applications. Therefore, the study of intelligent wireless communication and control becomes of importance. Moreover, the designed techniques and protocols should be flexible enough to meet the requirements of different verticals (e.g., in terms of connectivity, latency, security, energy efficiency, and reliability).

The aim of this Special Issue is to bring together original research that discuss artificial intelligence for 5G communications and beyond. Submissions should also include artificial intelligence for control networks. Review articles discussing the state of the art are also welcome.

Potential topics include but are not limited to the following:

- Joint communication, computing, and storage resources allocation
- Computation oriented communications
- Artificial intelligence for the convergence of communications, storage, and computing resources
- Distributed artificial intelligence and federated learning in wireless networks
- Wireless data offloading
- Energy efficient scheduling for Internet of Things applications
- Low latency in wireless networked control systems
- Multiple access protocols in systems with distributed computing resources
- Cloud and fog computing-based radio access networks
- Cross-layer based security management
- Wireless networks with multidimensional radio access and backhaul technologies
- Optimization of communication, storage, and computing resources in hybrid terrestrial-aerial networks

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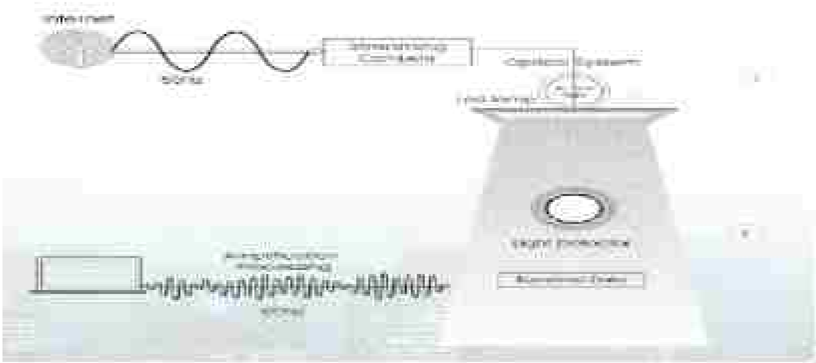
LiFi Technology: A Bright Future of Wireless Communication



In recent years, technology has seen significant advancements in wireless communication methods. The traditional Wi-Fi technology has been used for decades, but it comes with its limitations. LiFi (Light Fidelity) is a promising alternative wireless communication technology that is gaining popularity. This technology uses light waves to transmit data, offering higher data speeds and greater security. In this article, we will explore what LiFi is, how it works, its problems, and solutions.

LiFi is a wireless communication technology that uses visible light to transmit data. It works by modulating the intensity of the light source to transmit data, which is received by a receiver device. The technology offers several benefits, including higher data speeds, lower latency, and improved security. However, it also faces challenges such as limited range and susceptibility to interference from other light sources.

LiFi technology is based on the principle of Visible Light Communication (VLC), which involves using LED lights to transmit data. In LiFi, the LED light source is modulated to transmit data, which is then received by a photodetector on the receiving device. The data is transmitted through the light waves, and the photodetector decodes the data back into its original form.

The data transmission rate in LiFi can reach up to several gigabits per second, much faster than traditional Wi-Fi. The technology is also more secure as the light waves cannot pass through walls, making it difficult for unauthorized users to access the data.

One of the main challenges faced by LiFi technology is its limited range. As light cannot penetrate through solid objects, the range of LiFi is restricted to the area where the light can reach. Another challenge is the interference from other light sources, which can disrupt the data transmission.

LiFi technology has the potential to revolutionize wireless communication by offering faster data speeds and improved security. Although it faces some challenges, researchers are working to overcome them and improve the technology's performance. As the demand for faster and more secure communication grows, LiFi could become an essential part of our daily lives in the future.

Himanshu Shreedhar Koli

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International Space Station

Introduction:

This article explores the many factors that have been involved in International Space Station (ISS) on-orbit utilization activities, and the approaches that the National Aeronautics and Space Administration is taking to evaluate, communicate, and maximize the value of these activities. Methods. A review of the initiatives, stakeholders, vehicle assembly, science and technology outcomes, and benefits to Earth and space exploration illustrates the evolving nature of this unique microgravity research platform. Results. The ISS partnership works together to implement many strategic approaches to maximizing the ISS platform so that the full potential of this laboratory is realized.

Throughout the decades, the American public has recognized that their tax dollar investments in NASA programs provide returns that come in many different forms of benefits that impact their lives daily. Today's goals for the International Space Station (ISS) have evolved over its design and assembly phase, and are focused on providing benefits to those on Earth, advancing exploration of space beyond Low Earth Orbit (LEO), developing and maintaining international partnerships, and enabling a commercial demand-driven market in LEO. Because the research program of the ISS is like none other in existence, measuring the progress of accomplishing those goals comes in many different forms, and is communicated in as many ways. The utilization activities that are underway on ISS today keep ISS astronauts and Earth-based researchers busy, while the ISS partnership continually develops ongoing strategies that maximize all available resources. The National Aeronautics and Space Administration (NASA) is tasked with coordinating utilization activities across many stakeholders. The breakthroughs that will occur from this orbiting research platform are expected to drive advancements for all nations, both in space exploration and in benefits to those on Earth in this golden era of increased access to space.

The Engineering Achievements :

Having been in orbit for so long, it is easy to lose sight of the fact that it took around 15 years to build the ISS. More than 115 space flights were conducted on five different types of launch vehicles over the course of the station's construction to connect different modules that had been built on different continents around the world and had never even been integrated together until they reached space. Once in place, these modules were expected 1164 Social Science Quarterly to share pressure systems, power systems, and life-support systems that were designed based on merging globally different design and development practices and developing common standards of Russian, American, Canadian, European, and Japanese engineering. The ISS vehicle has now been operating this way 24 hours per day, seven days per week since the addition of its first components and is expected to continue for at least another decade from now. It is the only and longest running international microgravity research platform ever sustained in human history, and even during the assembly phase, the vehicle delivered its own "spinoffs" that are already benefiting humanity. For example, technology used to develop the water purification system specifically for use on the ISS has been applied to water technology on Earth in a way that can provide global communities access to clean water by filtering water from nearby lakes and rivers, with no power required .

EarthData:

The NASA Earth Observing System Data and Information System (EOSDIS) provides Earth science data to users from satellite, airborne, and ISS missions for long-term global observations of the land surface, biosphere, solid Earth, atmosphere, and oceans. This coordinated approach enables an improved understanding of the Earth as an integrated system.

About the International Space Station

The International Space Station (ISS) is one of the most ambitious engineering feats ever attempted, involving the United States, Russia, Canada, Japan, and the participating countries of the European Space Agency. On November 2, 2020, the ISS celebrated a remarkable anniversary in human history: 20 years of continuous human presence aboard the orbital outpost. A world-class laboratory in low Earth orbit, the ISS has supported numerous discoveries, scientific publications, unique opportunities, and historic breakthroughs. This research not only helps us explore farther into space, it also benefits humanity back

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