RISE MAGAZINE

Recent Innovations In Sophisticated Electronics

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

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INSIDE THIS ISSUE:

DEPARTMENT VISION
To be identified as a reputed technological department by offering quality education in Electronics and Communication Engineering so as to promote higher learning, research, provide professional career and produce creative solutions to social needs.

DEPARTMENT MISSION	
Mission1 (M1)	To impart quality technical education in Electronics and Communication Engineering with the best pedagogical atmosphere of the highest quality through modern infrastructure and cutting edge skills.
Mission2 (M2)	To promote the establishment of centre of excellence to foster the spirit of innovation and creativeness among faculty and students.
Mission3 (M3)	To develop leadership qualities and also provide ethical and value based education by encouraging operations focused on social needs.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs) **After successful completion of the program, the graduates can have the ability to**	
PEO1	Be cognizant in basic sciences, fundamental engineering stream along with contemporary problem solving, critical analytical skills in electronics and communication engineering and the allied fields.
PEO2	Understand the issues related to design and development; update the knowledge, and skills through continuous learning in the field of Electronics and Communication Engineering.
PEO3	Demonstrate their technical skills, communication skills and research abilities along with leadership skills in professional environment to empower employability, to go for higher education and to become entrepreneurs.
PEO4	Be motivated with high ethical, human values and team work towards development of the society.

PROGRAMME SPECIFIC OUTCOMES (PSOs) **At the end of the program, the student :**	
PSO1	Able to gain knowledge in diverse areas of electronics and communication for successful career entrepreneurship and higher studies.
PSO2	An ability to make use of acquired technical knowledge in core subjects to analyze and design process for variety of real time application, along with life skills to arrive appropriate solutions.

Blue Eyes Technology

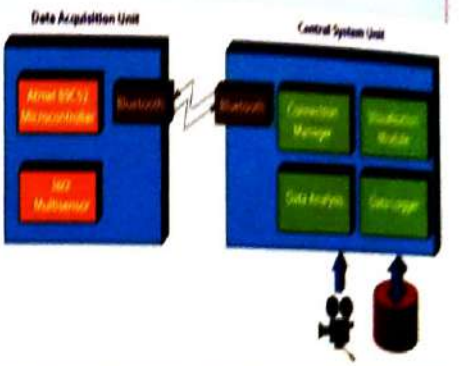
Blue Eyes is a technology conducted by the research team of IBM at its Almaden Research Center (ARC) in San Jose, California since 1997. Blue eyes technology makes a computer to understand and sense human feelings and behavior and also enables the computer to react according to the sensed emotional levels. The aim of the blue eyes technology is to give human power or abilities to a computer, so that the machine can naturally interact with human **beings** as we interact with each other. All human beings have some perceptual capabilities, the ability to understand each other's emotional level or feelings from their facial expressions. Blue eyes technology aims at creating a computer that have the abilities to understand the perceptual powers of human being by recognizing their facial expressions and react accordingly to them. Imagine, a beautiful world, where humans collaborate with computers!! .The computer can talk, listen or screech aloud!! .With the help of **speech recognition and facial recognition systems,** computers gathers information from the users and starts interacting with them according to their mood variations. Computer recognizes your emotional levels by a simple touch on the mouse and it can interact with us as an intimate partner. The machine feels your presence; verifies your identity and starts interacting with you and even it will dial and call to your home at any urgent situations. This all is happening with this **"Blue Eyes"** technology. The main objective of Blue eyes technology is to develop a computational machine having sensory and perceptual ability like those of humans. The Blue Eyes technology system is a combination of a set of hardware and software systems. The hardware consists of a central system unit (CSU) and data acquisition unit (DAU). Microcontroller- ATMEL 89C52 is the heart of the data acquisition unit. Bluetooth technology is provided for the coordination and communication between the two units. We can adapt this Blue Eyes technology in all working places, where the operator's attention is continually available. Using the Blue eyes Technology it is able to record and monitor the user's physiological condition by a technical approach. The aim of this Blue Eyes technology is to provide a machine or system having sensory and perceptual abilities like human beings thus it will support healthy stress free surroundings where the computers and humans can work together as intimate partners.

Blue eyes technology consist of,

1.Mobile measuring device or Data Acquisition Unit (DAU)
2.Central System Unit (CSU)
3.The Hardware

Mobile measuring device or Data Acquisition Unit(DAU) of Blue Eyes technology:

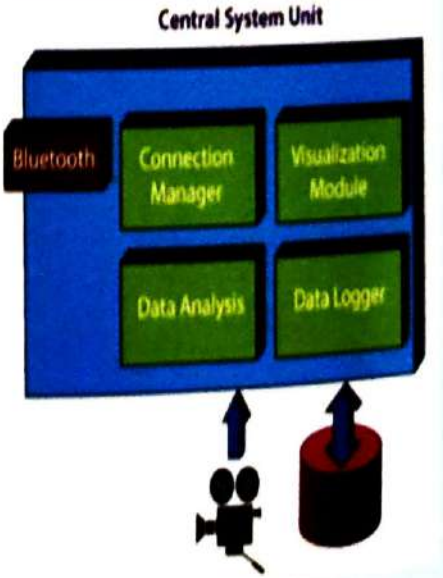
The DAU used in the Blue Eyes technology is the mobile component of the



system..The main function of DAU is to gather the physiological information from sensors and forward to the CSU for processing and verification purposes.

Central system Unit (CSU) of Blue Eyes technology:

CSU is the next squint of wireless-network connection in the Blue Eyes technology. The CSU mainly contains codec (PCM Codec commonly used for voice information transmission) and a wireless blue tooth module.



The blue tooth module, which is integrated with the mobile device (DAU), provides a wireless interface between the Central System Unit (CSU) and the user or operator having the sensors. PIN codes and ID cards are assigned to the entire operator's for authentication purposes. The device uses a five-key keyboard, beeper and LCD display for the interaction with the operators and if, any unwanted situation occurs, the machine uses these devices to inform the operators. The 'voice' information from the user is transferred with the help of a headset, which is interfaced with the Data Acquisition Unit using a mini jack plug. DAU incorporates various hardware modules like system-core Bluetooth section, Atmel 89C52 microcontroller, EEPROM, Beeper, LCD display (HD44780), LED indicator, voltage level monitors and 6 AA batteries. Central system Unit (CSU) of Blue Eyes technology:

CSU is the next squint of wireless-network connection in the Blue Eyes technology. The CSU mainly contains codec (PCM Codec commonly used for voice information transmission) and a wireless blue tooth module. This CSU section is integrated to a personal computer using USB, parallel and serial cable. The mini-jack socket is used for audio data accessing. The program containing the operators personal ID is amalgamating to the personal computer through the serial and power ports. The microcontroller (Atmel- 89C2051) inside the unit handles the I2C EEPROM- programming and UART transmission The steps involved for designing such type of computers are given below.

Process of giving sensing capacity.

Human Emotion detection or Affect Detection.

Respond appropriately and properly.

1. Process of giving sensing capacity:

2. Detecting human emotions/ Affect Detection:

Types of Emotion Sensors used in Blue Eyes Technology:

- For Hand - Emotion Mouse:

The major aim of Brain Computer Interface (BCI) is to develop a smart and adaptive computer system. These types of project must include speech recognition, eye tracking, facial recognition, gesture recognition etc. software and hardware. Similarly in Blue Eyes technologies, we need to build a system have the ability to identify all these perceptual abilities of human beings. In Blue Eyes, the machines have the ability to identify the minor variations in the moods of human beings. Say a person may strike the keyboard hastily or softly depends on his mood like happy or in angry. The Blue Eyes technology enables the machines to identify these minor emotional variations of human beings even by a single touch on the mouse or key board and the machines started to react with the users according to this emotional levels. This is done with the guidance of intelligent devices like "Emotion Mouse". Actually

this Emotion Mouse is an input device to track the emotions of a user by a simple touch on it. The Emotion Mouse is designed to evaluate and identify the user's emotions such as fear, surprise, anger, sadness, happiness, disgust etc. when he/she is interacting with computer. The main objective of the Emotion Mouse is to gather the user's physical and physiological information by a simple touch.

- **For Eye - Expression Glass:**

Expression Glass is an alternative for the usually available machine vision face or eye recognition methods. By analyzing pattern recognition methods and facial muscle variations, the glass senses and identifies the expressions such as interest or confusion of the user. The prototype used for this glass uses piezoelectric sensors.

Conclusion:

BLUE EYES technological approach assure a convenient technique, that simplifies the life by supporting more elegant and user friendly provision in computing devices. The day is very near, that this Blue Eyes technology will advance its way towards your house hold devices and makes you lazier. In future, even this Blue Eyes will reach as your hand held

mobile device

Presented by
BAKU APARNA
(169E1A0415)

SMART DUST

Smart Dust devices are small wireless microelectromechanical sensors (MEMS) that can detect everything from light to vibrations. It is a tiny dust size device with extraordinary capabilities. It encompasses nano-structured silicon sensor which can spontaneously assemble, orient sense and report on their local environment. This new technology combines sensing, computing, wireless communication capabilities and autonomous power supply within the volume of only a few millimeters. It is very hard to detect the presence of the Smart Dust and it is even harder to get rid of them once deployed. Smart Dust is useful in monitoring real world phenomenon without disturbing the original

The Key Components of Smart Dust:

A semiconductor laser diode and MEMS beam steering mirror for active optical transmission

Corner Cube Retro reflector (CCR) for passive optical transmission

Photo detector and receiver

- An optical receiver
- A signal processing and control circuitry
- A power source based on thick-film batteries and solar cells.

Construction Of Smart Dust

The new trend of the 21st century is to provide the best adaptive features to the user in small packages as much as possible. This same trend is being followed in electronics technology and the enhance features are being provided in smaller and smaller electronic devices. An example of this technology trend is electronic motes. These are so small and light in weight that they can remain suspended in the environment like an ordinary dust particle. Even the air currents can also move them in the direction of flow. The main features of motes are:

- Support the collection and integration of data from a variety of miniature sensors.

Analyze the sensor data as specified by system level controls. Wirelessly communicate the results of their analyses to other motes, system base stations, and the internet as specified by system automation.

Motes are also sometimes referred to as smart dust. One mote is composed of a small, low powered and cheap computer

connected to several sensors and a radio transmitter capable of forming ad hoc networks. The computer monitors the different sensors in a mote. These sensors can measure light, acceleration, position, stress, pressure, humidity, sound, and vibration. Data gathered are passed on to the radio link for transmission from mote to mote until data reaches the transmission node.

Working Principle of Smart Dust:

Smart Dust motes are run by microcontrollers. These microcontrollers consist of tiny sensors for recording various type of data. Timers are used to run these sensors. These sensors do the job of collecting the data. The data obtained are stored in its memory for further interpretations. It can also be sent to the base controlling stations.

CCR, that comprises of three mutually perpendicular mirrors of gold coated polysilicon, has the property that any incident ray of light is reflected back to the source provided that is incident within a certain range of angles centered about the cubes body diagonal. The

Micro fabricated CCR includes an electrostatic actuator that can deflect one of the mirrors

at kilohertz rate. Hence , the external light source can be transmitted back in the form of the modulated signal at kilobits per second. It can transmit to the bus only when the CCR body diagonal happens to point directly towards the bits, within a few tens of degrees

Although a passive transmitter can be made more omnidirectional by employing several CCR"s oriented in different directions, at the expense of increased dust mote size.

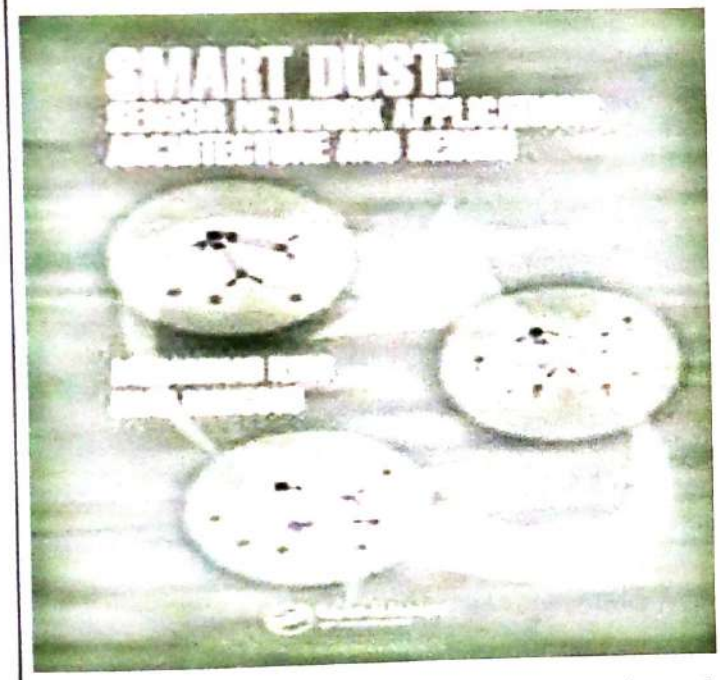
Telemedicine can be utilized to improve the efficiency and effectiveness of the delivery of care in a trauma environment. Examples include:

Telemedicine for trauma triage: using telemedicine, trauma specialists can interact with personnel on the scene of a mass casualty or disaster situation, via the internet using mobile devices, to de-

Limitations and Challenging Factors

- Sensor nodes are highly prone to breakdown and energy exhaust, while the battery management tends to be weaker because they are usually not rechargeable or replaceable.
- Sensor nodes presumably will not be backed by global identifiers and naturally the chance of unique addressing would not be feasible.
- Sensor networks are data-driven; hence the devices will only be effective against data satisfying conditions.

Sensor nodes are erratically deployed and don't follow any standard rules, which make them unfit for unusual topology. Once installed, they will not require any human involvement. Naturally, maintenance or fixing of the network would be completely self-governing. Sensor networks are basically framework-less, which makes them disturbing to every routing or upholding algorithm. Since sensors rely on battery power, the availability of energy at these nodes might be limited especially if the batteries can't be changed or replaced.
To make them energy efficient, the newest techniques of the OS, micro-controller, and application software need to be designed.



Future of smart dust: According to researchers, the smart dust hypothesis of monitoring every element of our earth will be highly beneficial to humankind. Organizations like Streetline, have already introduced around 12,000 sensors on different parking areas and highroads in San Francisco. The sensors are integrated with magnetometers to assess and sense if any big metal object is sitting on a specific spot, identifying a car. According to futurist Alvin Toffler in Investor's Business Daily, smart dust is likely to be the core industries of the future world
The ARC Advisory Group reports the potential net sales of smart dust should reach the level of $344 million by this year. The reality factor establishes the possibility of using smart dust in the areas like security, medicine, space exploration, etc. Large corporations such as General Electric, Emerson Electric, or Cargill are highly inspired to use these dust sensors in their technology areas. Tech Giants, Cisco Systems and IBM art sensors stated in a press conference that each node of smart dust elements can interact with each other by means of a web of wireless radio indicators that advances the level of technology in the most consistent way to track widespread industrial systems.

Presented by
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(169E1A04B9)

POWER CONSUMPTION FROM URINE

Urine consists of approximately 98 per cent water and 2 per cent urea, which is made up of carbon, oxygen, nitrogen, and hydrogen atoms. Human urine has been turned into all sorts of things over the centuries, ranging from phosphorous to gunpowder. It has also served as the basis of myriad chemical substances, including the first types of plastics. It is already well-known that manure or poop can be recycled for making products, such as paper as well as creating biogas power from methane gas. This readily available 'resource', whether from animal or human origin, is now being experimented to actually generate electricity by using its basic ingredients to create enough hydrogen to provide electricity for both homes and businesses. Today, over seven billion people populate our planet, which means on an average, around 10.5 billion litres (2.8 billion gallons) of human urine is produced and wasted each day.

However, scientists are now hopeful that they can use this to generate power—for homes, cities, and vehicles. The process of electrolysis uses a jolt of electricity to split the urea into hydrogen and oxygen atoms and then captures the hydrogen to produce energy. The nitrogen can be used for artificial fertilizers. Researchers have also built a urinal that converts urine directly into electricity. The urinal prototype uses fuel cells to generate a steady stream of electricity. Students in Nigeria have come up with a power generator that runs on human urine. Their creation uses the process of electrolysis

to isolate hydrogen gas from urine which is then used to power a generator. They earn a whopping six hours of power from one litre of urine, which does not seem like much until we consider that a normal person pees out roughly two litres per day. The model (Picture 1) was created by four students and the system developed works as follows: Urine is put into an electrolytic cell, which separates out the hydrogen The hydrogen enters a water filter for purification, which then gets pushed into a gas cylinder The gas cylinder pushes hydrogen into a cylinder of liquid borax, which is used to remove moisture from the hydrogen This purified hydrogen gas is pushed into the generator Technological Potential Prior to the development of this technology, a firm, E3 Technologies, LLC, based in Athens, Ohio (USA), has developed and patented a similar technology called the 'Greenbox', to clean commercial and agricultural waste water and produce hydrogen energy. It is a low-energy electrolysis process that converts ammonia and urea in waste water to hydrogen, nitrogen, and pure water. The electric current in the device creates an electrochemical reaction that oxidizes urea and turns it into carbon dioxide which is then moved into the electrolyte material in the machine, while, the kids are making use of urea electrolysis to generate hydrogen and using the hydrogen to create electricity. Although still a long way off from being implemented on a mass scale, this basic way of creating electricity from a substance normally disposed of can be a practical way to create electricity in places where regular electrical supply has been cut off due to devastation by natural disasters. Students and faculty at Bristol-based University of the West of England are being asked to use a special urinal that sends all the urine collected to be used to produce hydrogen for powering an electric generator that creates additional electricity for the campus (Picture 2). A technology like this would only require 1 kW of power to operate an entire commercial building with 300 employees. A team from a Korean university has come up with a plan about the recovery of carbon atoms from human urine and then using it to produce cheap electricity. This will be achieved by replacing the platinum catalyst that is currently used in fuel cells with carbon that is naturally found in human waste. Fuel cells are quite promising and convert chemical energy into electrical energy by a reaction that occurs between hydrogen and oxygen..

In the modern era, communication plays a significant role in human life, a country's economy and further development in science and technology. The communication system has developed to an extent that information exchange across any part of the blue planet is very easy. This is possible due to the satellites revolving around us. Every nook and corner of the earth can be accessed via satellites.

As Newton said, "For every action there is an equal and opposite reaction", the development in the satellite technology heads in one direction launching many satellites and the debris created due to these satellites possess a threat of destroying the satellites and heads in the opposite direction. In the next 100 years, man's thirst for wider and better universal communication will lead in launching of many satellites which in turn produces huge amount of debris. The space around the earth would get so congested that it needs to be cleaned. We have discussed about the various

By using the approach explained here, Korean researchers are quite hopeful that they can lower the price for the fuel cells. This will be achieved by replacing the platinum catalyst that is used in fuel cells currently with carbon that is naturally found in human waste. Urine-tricity successfully demonstrated the charging of a commercially available mobile phone, using microbial fuel cells (MFCs) fed with real neat urine.

Today, the urine-based electric generators generate enough energy for a smart phone to text, browse the internet and make short phone calls, but, eventually these could help power houses, buildings, and maybe even entire off-grid villages.

Bottlenecks Energy from urine could really be the energy of the future and a significant solution for billions of people around the world who lack access to electricity. Currently, the biggest hurdles are cost, scale, and output. Allowing the huge number of toilet/fuel cell combinations out in the field is itself a huge logistical problem along with the cost involved. At the commercial level, these systems could be applied to wastewater treatment plants, saving tremendous energy costs by effectively recovering energy during the process of treating urine, and feeding it back into the system

while the dialog box is open. For example, RAS calls your RasPBDlgFunc function if the user dials, edits, creates, or deletes a phone-book entry.

The idea of using urine as fuel is not new. The girls have come up with a practical way to put the idea into action, though. Their method for using urine to power a generator is one the average household can appreciate.

Power generators are used far more often in Africa than here, where they are relegated more to emergency use, as in the aftermath of Hurricane Sandy. The Maker Faire Africa blog says power outages happen multiple times a day in Lagos, so all those who can afford a backup generator have one.

Still, technology needs to evolve further before such a system is feasible, at least as far as applications like powering generators go.

Gerardine Botte, a professor of chemical and biomolecular engineering at Ohio University, is among those working on practical ways to make urine into a more useful hydrogen source, essentially by turning power into a byproduct of wastewater treatment. She says it takes more energy to extract hydrogen from urine than you end up getting in return as electricity. The energy equation gets even more skewed by the inefficiency of the generator used in the girls' project.

"At first glance, they're not having a net gain in energy," Botte says. "But I think it's important to say that these little girls, trying to do something like this, deserve a lot of credit."

The idea behind the humble urine-powered generator is along the lines of Botte's own thinking, and her research is all about efficient ways to break urine down into its useful components.

Botte's approach is to use electrolysis of urea as a method of wastewater treatment. She says her process for converting urine into potable water is more cost effective and more energy efficient than current wastewater treatment methods. Pure hydrogen is produced as a byproduct and can be used in generating electricity.

"You cannot get net energy gain, but there is no more efficient way to get clean water from urine," Botte says.

Botte founded E3 Clean Technologies in 2011 to work on scaling the process for use by municipalities and others.

The U.S. Department of Defense is trying out a portable system from E3 at military bases in remote areas, as both a way to treat wastewater and generate power. The system, which Botte calls GreenBox technology, converts a soldier's urine into drinking water.

"At forward operating bases, the main needs are water and fuel," Botte says. "With this project, they're doing both, using less energy to reutilize water sources."

So, when put in the context of wastewater treatment, the concept of using urine as a hydrogen source to produce energy has great potential.

Since wastewater treatment plants already collect the raw material needed – urine – extracting hydrogen from it makes sense, Botte says. Doing so could regain some of the vast amounts of energy already being spent all over the world to treat waste.

"You will never get more energy out than you put in," she says. "But it is a unique and elegant way to treat urine waste, which will allow you to co-generate electricity."

Presented by
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(169E1A04C5)

INTRODUCTION TO EDGE COMPUTING

What is edge computing?

Gartner defines edge computing as "a part of a distributed computing topology in which information processing is located close to the edge – where things and people produce or consume that information."

At its basic level, edge computing brings computation and data storage closer to the devices where it's being gathered, rather than relying on a central location that can be thousands of miles away. This is done so that data, especially real-time data, does not suffer latency issues that can affect an application's performance. In addition, companies can save money by having the processing done locally, reducing the amount of data that needs to be processed in a centralized or cloud-based location.

Edge computing was developed due to the exponential growth of IoT devices, which connect to the internet for either receiving information from the cloud or delivering data back to the cloud. And many IoT devices generate enormous amounts of data during the course of their operations.

Network World / IDG

Think about devices that monitor manufacturing equipment on a factory floor, or an internet-connected video camera that sends live footage from a remote office. While a single device producing data can transmit it across a network quite easily, problems arise when the number of devices transmitting data at the same time grows. Instead of one video camera transmitting live footage, multiply that by hundreds or thousands of devices. Not only will quality suffer due to latency, but the costs in bandwidth can be tremendous.

Edge-computing hardware and services help solve this problem by being a local source of processing and storage for many of these systems. An edge gateway, for example, can process data from an edge device, and then send only the relevant data back through the cloud, reducing bandwidth needs. Or it can send data back to the edge device in the case of real-time application needs.

These edge devices can include many different things, such as an IoT sensor, an employee's notebook computer, their latest smartphone, the security camera or even the internet-connected microwave oven in the office break room. Edge gateways themselves are considered edge devices within an edge-computing infrastructure.

Why does edge computing matter?

For many companies, the cost savings alone can be a driver towards deploying an edge-computing architecture. Companies that embraced the cloud for many of their applications may have discovered that the costs in bandwidth were higher than they expected.

Increasingly, though, the biggest benefit of edge computing is the ability to process and store data faster, enabling for more efficient real-time applications that are critical to companies. Before edge computing, a smartphone scanning a person's face for facial recognition would need to run the facial recognition algorithm through a cloud-based service, which would take a lot of time to process. With an edge computing model, the algorithm could run locally on an edge server or gateway, or even on the smartphone itself, given the increasing power of smartphones. Applications such as virtual and augmented reality, self-driving cars, smart cities and even building-automation systems require fast processing and response.

"Edge computing has evolved significantly from the days of isolated IT at ROBO [Remote Office Branch Office] locations," says Kuba Stolarski, a research director at IDC, in the "Worldwide Edge Infrastructure (Compute and Storage) Forecast, 2019-2023" report. "With enhanced interconnectivity enabling improved edge access to more core applications, and with new IoT and industry-specific business use cases, edge infrastructure is poised to be one of the main growth engines in the server and storage market for the next decade and beyond."

Companies such as NVIDIA have recognized the need for more processing at the edge, which is why we're seeing new system modules that include artificial intelligence functionality built into them. The company's latest Jetson Xavier NX module, for example, is smaller than a credit-card, and can be built into smaller devices such as drones, robots and medical devices. AI algorithms require large amounts of processing power, which is why most of them run via cloud services. The growth of AI chipsets that can handle processing at the edge will allow for better real-time responses within applications that need instant computing.

Privacy and security:

However, as is the case with many new technologies, solving one problem can create others. From a security standpoint, data at the edge can be troublesome, especially when it's being handled by different devices that might not be as secure as a centralized or cloud-based system. As the number of IoT devices grow, it's imperative that IT understand the potential security issues around these devices, and to make sure those systems can be secured. This includes making sure that data is encrypted, and that the correct access-control methods and even VPN tunneling is utilized.

Presented by
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