

D E P A R T M E N T A L

J O U R N A L

**DEPARTMENT OF ELECTRONICS AND
TELECOMMUNICATION ENGINEERING**




TECHNOTRONICS

VOLUME-7

TECHNIQUE POLYTECHNIC INSTITUTE

PANCHROKHI, SUGANDHYA

HOOGLY - 712102



Departmental Journal on Electronics and Telecommunication Engineering

Department of Electronics and Telecommunication Engineering

TECHNIQUE POLYTECHNIC INSTITUTE

Panchrokhī, Sugandhya, Hooghly, West Bengal Pin-712102



TECHNOTRONICS

VOLUME: 7

PUBLISHER

Department of Electronics & Telecommunication Engineering

Technique Polytechnic Institute

E-mail: detce@techniqueedu.com

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Engineering





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To be a centre of excellence in Electronics and Telecommunication engineering for development of technical man power capable of facing new challenges in industry and society at large.

Departmental Mission

- *To implement quality learning teaching process for developing skilled technological man power.*
- *To impart value based education through structured programme and industrial training resulting wages earning capability with entrepreneur initiatives.*
- *To inculcate critical thinking for solving technological problem, professional skill in engineering practices with the attitude of life-long learning.*





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Technotronics Volume 5 is a departmental magazine to publish significant technical information in all areas of Electronics and Tele-communication Engineering. Published articles in this magazine will address important research topics and new technological advancements in this field. The main aim is to motivate students and faculty members in research works and to increase their knowledge domain. It will give them an opportunity to express their ability of writing technical papers and documentations. The intended audience may submit their research documents yearly in the community of scholars, interested in social impact of new advanced technologies. This Magazine was initiated by the department of Electronics & Tele-communication Engineering. Students and faculty members are cordially supported by the students and faculty members of all other departments.

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Manuscripts are invited from academicians and students of this institution for publication in this magazine. Papers are accepted for editorial considerations through e-mail detce@techniqueedu.com with the understanding that they have relevant and logical issues regarding the new trends in technology.

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One volume of this journal will be published yearly.

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Green Hydrogen: Fuel of the Future

Sibasis Bandyopadhyay

In-Charge, DETCE

India is the planet's third-biggest emitter of greenhouse gases, after China and the US. In a bid to decarbonize India's economy Government is giving top priority to renewable energy and also to a new fuel, termed 'green hydrogen'. The potential of green hydrogen in the country was highlighted by last year's report from The Energy and Resources Institute.

Globally, Hydrogen is the latest buzz for supplementing world's energy needs. Being the cleanest form of energy, it can be produced from a variety of resources, such as natural gas, biomass, and renewable power like solar and wind. It can be used in cars, in houses, for portable power and in many more applications.

Green hydrogen is derived from water electrolysis using renewable energy such as solar or wind and can replace carbon-emitting fuels such as petrol and diesel, helping to meet United Nation's Sustainable goals. Thrust is being provided by both private and public sector companies. For instance, National Thermal Power Corporation is working to set up India's first green hydrogen fuelling station in Leh, Ladakh.

ONGOING Russia-Ukraine crisis added to uncertainty in the international energy markets. Given that India imports 85% of its oil and 55% of natural gas requirements, the energy security assumes paramount importance.

On the other hand, widespread use of fossil fuels is leading to environment degradation, playing havoc with our lives causing climate change including unprecedented rainfalls, hurricanes, landslides and melting of glaciers. In this disturbing scenario, alternatives in the form of renewable energy are actively sought for. Now a new candidate appears on the horizon.

Its name is Green hydrogen. Currently, all hydrogen consumed in India comes from fossil fuels. However, by 2050, three-fourths of all hydrogen is projected to be green, produced by renewable electricity and electrolysis.

Manufacturing process involves electrolysis to split water. It is different from 'grey' hydrogen, which is produced from methane and releases greenhouse gases into the atmosphere, and 'blue' hydrogen, which captures such emissions and stores them underground to prevent them causing climate change.

According to Goldman Sachs, Green hydrogen could supply up to 25% of the world's energy needs by 2050 and become a \$10 trillion addressable market by 2050. Scaling up green hydrogen will be essential to achieve net zero emissions by 2050 and limit global temperature rises to 1.5°C.

Apart from the fact that green hydrogen is a sustainable and zero emission fuel, it is a better alternative to Electric Vehicles. Vehicles powered by green hydrogen fuel get charged faster as compared to EVs. Moreover, green hydrogen as auto fuel is also a cleaner alternative as its method of generation uses only renewable resources, whereas substantial fraction of electricity is still generated using fossil fuels.



Fig. 1: India's first green hydrogen electrolyzer giga-factory was launched at Bengaluru by Ohmium International, a US-based renewable energy start-up through its India subsidiary.

Corporates Initiatives

India announced Green Hydrogen Mission on 15th August 2021. As a result of the propitious policy ecosystem, many companies announced their plans to enter the field. Reliance, Adani Group, Indian Oil and National Thermal Power Corporation (NTPC) among others are leading India's mission to adopt green hydrogen. Mukesh Ambani-led Reliance Industries recently announced its hydrogen plans to become a net carbon-zero firm by 2035. The company aims to replace transportation fuels with clean electricity and hydrogen. In March last year, the Adani Group announced a partnership with Maire Tecnimont to develop green hydrogen projects. Indian Oil Co has a wind power project in Rajasthan, from where, it intends to wheel power to Mathura refinery to produce green hydrogen through electrolysis.

NTPC announced its plans to set up India's first green hydrogen fuelling station in Leh, Ladakh. It is looking to set up a pilot project for blending hydrogen with national gas for use in city gas distribution. Additionally, NTPC plans to produce green hydrogen from its upcoming 4,750 MW renewable energy park at the Rann of Kutch. Currently, it is running a pilot project in its Vindhyanchal unit, where the cost of hydrogen is estimated to be around \$2.8-3/kg. It also plans to come up with a stand-alone green hydrogen manufacturing unit in Kochi that will draw energy from the solar power facility of the Kochi International Airport. Oil India is setting up a plant to manufacture green hydrogen at its oilfield in Assam. The company has initiated action for setting up 100 kW green hydrogen plant at its pump station-3 in Jorhat. The pilot plant will generate green hydrogen using AEM technology. This is a first-of-its-kind project in the country. The hydrogen so generated will be blended with natural gas using the existing infrastructure.

GAIL (India) plans to build India's largest green hydrogen plant for which it finalized 2-3 sites including one at Vijapur in MP. It will take 12-14 months to set up the plant. The hydrogen so produced can be sold to fertiliser units which as per government mandate are required to use hydrogen as fuel.

Fusion Fuel Green — which has offices in Ireland and Portugal — signed an agreement with BGR Energy Systems, Chennai for development of green hydrogen projects in India. It will use proprietary technology from Fusion Fuel Green which produces hydrogen using solar energy. Green hydrogen will be used as a feedstock for other heavy industrial applications. Acme Solar Holdings Ltd also announced its green hydrogen plans. Engineering major, L&T plans to set up a green hydrogen plants at Hazira complex and other manufacturing units. It will spend between Rs.10-50 bn on its green initiatives, spread over a number of years.

Background

Described by the International Energy Agency as a “versatile energy carrier,” hydrogen has a diverse range of applications and can be deployed in sectors such as industry and transport. Examples of its use in transport include cars, buses, trains, and airplanes. Hydrogen can be produced in a number of ways. One method includes using electrolysis, with an electric current splitting water into oxygen and hydrogen. If the electricity used in the process comes from a renewable source such as wind or solar then it's termed “green” hydrogen.

So-called “blue hydrogen” refers to hydrogen produced using fossil fuels — usually natural gas — with the associated emissions captured and stored. Green hydrogen — which is currently expensive to produce — accounted for just 0.1% of worldwide hydrogen production in 2020, according to Wood Mackenzie.

Hydrogen fuel cell vehicles can be charged in 5-15 minutes.



India's aims: The potential of green hydrogen in India was highlighted by a recent report from The Energy and Resources Institute. It projects that by 2050, 80% of India's hydrogen is projected to be 'green'. In the mid-term, the cost of hydrogen from renewables would drop by over 50% by 2030, enabling it to start to compete with hydrogen produced from fossil fuels.

Government is targeting 450 GW of renewable capacity by 2030. The ambition to become a more sustainable country represents a significant challenge: India is the planet's third biggest emitter of greenhouse gases, with only China and the US ahead of it.

A changing landscape: In February, India's Ministry of Petroleum & Natural Gas said a statement of intent had been signed between Indian Oil and Greenstat Hydrogen India, a subsidiary of Norwegian energy company Greenstat, to establish a Center of Excellence on Hydrogen to promote R&D projects in Green and Blue Hydrogen between Norwegian and Indian R&D institutions/universities. Greenko Group and Belgium's John Cockerill plan to set up a 2 GW electrolyzer factory in India, through their joint venture at an investment of \$500 million. This facility has the potential to help replace around 8% of India's annual liquified natural gas (LNG) imports.

According to IEA's World Energy Outlook 2020, battery storage will gain huge ground as a source of power system flexibility, with global investment increasing six-fold to \$25 billion by 2030.

Even as the country aims to reduce fossil fuel-based emissions by building renewable energy capacity and promoting the uptake of electric vehicles, the cost of such a transition remains unaffordable for many Indian consumers.

Industry's Challenges

Industry has a number of challenges to overcome. First of all, Hydrogen research in the country is underfunded. In the 2020-21 budget, only Rs.250 m was allocated to the Ministry of New and Renewable Energy for hydrogen-related R&D. In comparison, Rs.61 bn was offered by the German government to firms working on green hydrogen alone. Producing green hydrogen is an expensive undertaking with the biggest cost being the electrolyzer. The membrane-electrode unit accounts for 60% to 70% of its cost while precious metals account for the rest. Hydrogen is also an expensive fuel to move. The gas needs to be cooled to -252°C before transportation. While it can be stored as ammonia, a more stable form, reconversion is expensive.

Global Initiative

Over 8,000 hydrogen cars are on US roads. USA's new initiative aims to cut the cost of production of green hydrogen to less than \$2/kg, which would help to cut emissions from the world's most carbon-intensive industries including steel-making, shipping, chemicals production and power generation. A number of countries have recently published national hydrogen strategies, including Australia, Chile, Germany, the EU, Japan, New Zealand, Portugal, Spain and South Korea.

The European Commission is working on a Clean Hydrogen Alliance while the German government is debating its national hydrogen strategy. Recently, Airbus, the world's second largest aviation manufacturer, revealed prototypes for a hydrogen fuel passenger aircraft and a timeline for production to 2035, the International Renewable Energy Agency (IRENA) gathered global public and industry stakeholders to discuss how green hydrogen can advance towards cost competitiveness. Of Germany's EUR 9 billion investment earmarked for green hydrogen production, close to a quarter of it will support international cooperation, recognizing the potential need to import the fuel in large quantities as national policies stimulate demand. The cost reductions needed to make hydrogen competitive with fossil fuels remain contingent upon rapid and significant scale-up of its production. According to Michele Azalbert, representing the Hydrogen Council, by 2050, hydrogen could be a \$2.5 trillion industry employing workforce of 30 million.

Internet of Things (IoT)

Abhishek Dey

Course In-Charge, DETCE

Internet of Things (IoT) is a network of physical objects or people called “things” that are embedded with software, electronics, network, and sensors that allows these objects to collect and exchange data. The goal of IoT is to extend to internet connectivity from standard devices like computer, mobile, tablet to relatively dumb devices like a toaster.

IoT makes virtually everything “smart,” by improving aspects of our life with the power of data collection, AI algorithm, and networks. The thing in IoT can also be a person with a diabetes monitor implant, an animal with tracking devices, etc. This IoT tutorial for beginners covers all the Basics of IoT.



History of IoT

- 1970- The actual idea of connected devices was proposed
- 1990- John Romkey created a toaster which could be turned on/off over the Internet
- 1995- Siemens introduced the first cellular module built for M2M
- 1999- The term “Internet of Things” was used by Kevin Ashton during his work at P&G which became widely accepted
- 2004 – The term was mentioned in famous publications like the Guardian, Boston Globe, and Scientific American
- 2005-UN’s International Telecommunications Union (ITU) published its first report on this topic.
- 2008- The Internet of Things was born
- 2011- Gartner, the market research company, include “The Internet of Things” technology in their research

Need for IoT:

IoT is widely used in almost all of the big organizations and MNCs due to its benefits which help them to improve their standard of communication and work by offering them a platform to share data across the globe without any restrictions.

Data is the reflection of a business or a company’s performance and by sharing data with all of its stakeholders, the true picture of a firm is brought to light, leading to further updates and corrections.

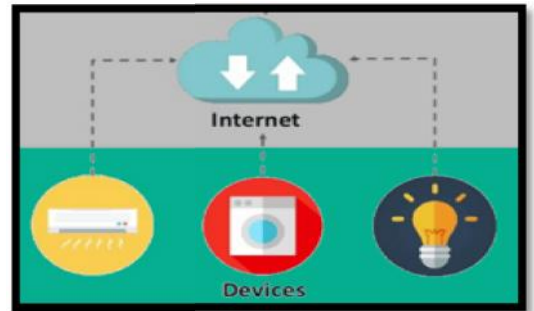
- IoT brings in transparent customer-relations.
- IoT’s ‘track and monitor’ feature helps one to control the organization’s happenings from one place.
- Sharing data/insights lead to better decision making.
- It provides the real picture of one’s systems and their usage.

- The automation feature reduces work pressure and the money spent on labourers.
- A company's service can be improved without spending much money.

How IoT works?

The entire IoT process starts with the devices themselves like smart phones, smart watches, electronic appliances like TV, Washing Machine which helps you to communicate with the IoT platform.

Four fundamental components of an IoT system:



1) Sensors/Devices: Sensors or devices are a key component that helps you to collect live data from the surrounding environment. All this data may have various levels of complexities. It could be a simple temperature monitoring sensor, or it may be in the form of the video feed. A device may have various types of sensors which performs multiple tasks **apart** from sensing. Example, A mobile phone is a device which has multiple sensors like GPS, camera but smart-phone is not able to sense these things.

2) Connectivity: All the collected data is sent to a cloud infrastructure. The sensors should be connected to the cloud using various mediums of communications. These communication mediums include mobile or satellite networks, Bluetooth, WI-FI, WAN, etc.

3) Data Processing: Once that data is collected, and it gets to the cloud, the software performs processing on the gathered data. This process can be just checking the temperature, reading on devices like AC or heaters. However, it can sometimes also be very complex like identifying objects, using computer vision on video.

4) User Interface: The information needs to be available to the end-user in some way which can be achieved by triggering alarms on their phones or sending them notification through email or text message. The user sometimes might need an interface which actively checks their IoT system. For example, the user has a camera installed in his home. He wants to access video recording and all the feeds with the help of a web server.

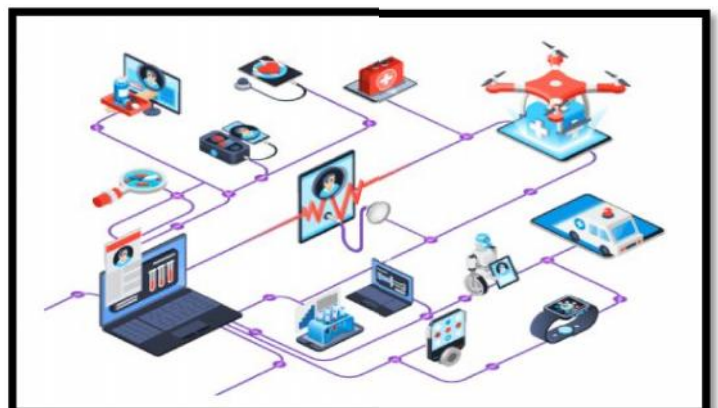
IoT Applications

The ubiquity of the Internet of Things is a fact of life thanks to its adoption by a wide range of industries. IoT's versatility makes it an attractive option for so many businesses, organizations, and government branches, that it doesn't make sense to ignore it. Few area of applications are mentioned below:

1. Healthcare:

IoT deals with healthcare through its connection mechanisms. Devices like smart-watches or fitness bands or stress detectors are a great example of IoT applications that involve the welfare of the public.

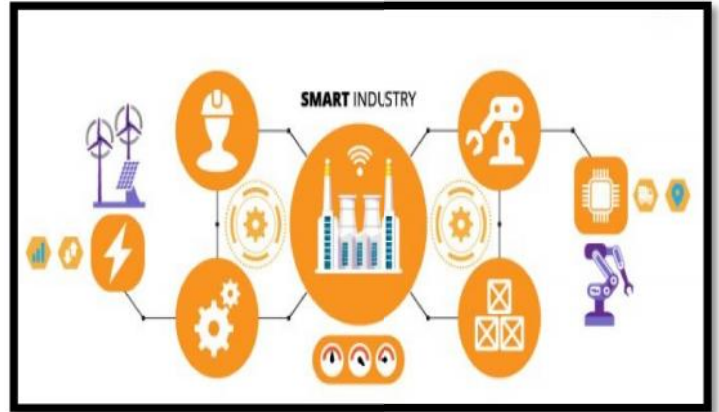
Other smart medical devices used in companies lead to a better healthcare system too. An individual's health and the ways to improve it are all known to them via these healthcare devices. The base for this application is IoT's ability to connect devices, collect data through sensors, and analyze them to form the right results.



2. Industrial Use:

As the name suggests, this application deals mostly with the industrial sector than the personal sector. IoT applications deal with developing the industry and its working methods with the help of software used for data analysis, sensors, tracking devices, and machines that are effective and masterly.

These help a firm to have accurate, enhanced, and transparent functioning. One can not only improve things but can also identify the damaged spots for an accurate cure. When IoT is used in industries, a sustainable approach is well-established.



3. Smart Homes:

When the homes are at their best when their lives will be the best too.

However, in order to make your homes smart, the application of IoT is necessary as it helps the owner to control and supervise their lights, security, fans, water supply, and other home devices through any of their smart devices.

In short, a smart home is a modern-technological experience that will help the owners save their money, time, and energy spent on their daily-life.



4. Smart City:

When the homes in the city become smart, so does the city which gets to have many infrastructural developments due to IoT applications. IoT also has its way around in the transport sector, government services sector, traffic management sector, health care, agricultural sector, water and energy sectors, and also in the waste management sector, which leads to a sustainable way of living by removing the difficulties of the living population.

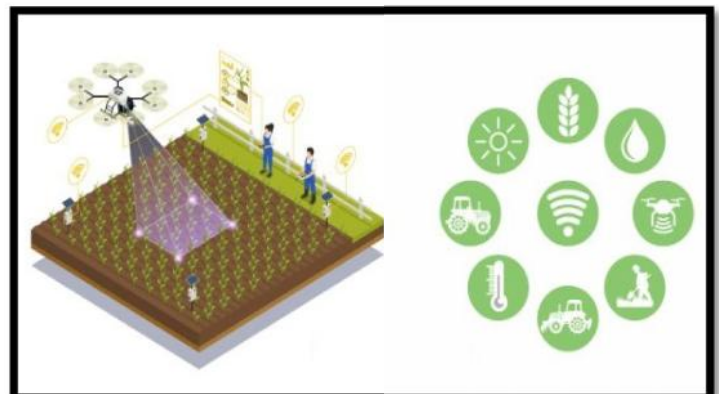
Cities are also protected and observed for security and development through IoT.



5. Agriculture:

Agriculture is always the need-in-hour service and with the due increase in population, its demand rises too. However, in order to meet the current and future farming needs, farmers should use smart methods and techniques.

IoT offers many such smart techniques like its automation feature helps the farmers to fertilize their plants at regular intervals, keep a check on the usage of water, be aware of the right time to harvest. analyze the soil's texture, nutrients, and also its ability to yield.



6. Smart Supply Chain:

A supply chain deals with the process involved in delivering a product or service to a consumer. When the traditional methods are used, this supply chain charges more manpower and thus more money, energy, and time.

However, when IoT is applied here, then through its tracking systems (GPS / Radio Frequency) and sensors, one can easily, without much pressure and money involved, can track their goods, the shipment process, and also the transportation operations.

IoT sensors can be used to know the effectiveness of each machine and its work settings can also be changed, if necessary. With less manpower, but more work is done, the company's work is optimized at all levels.



7. Retail Purpose:

Retailing is all about connecting with the consumers on a more personal level and IoT enables a retailer to stay connected with their consumers with the help of their smart-phones.

Through this connection, the retailers get real feedback from their consumers and also help them find the demand in their particular place in order to change their goods supply accordingly.

On the whole, the overall in-store experience is enhanced to meet the needs of their prospective customers, goods are advertised effectively, and the supply chains are well maintained. Even payment procedures are enhanced.



8. Transportation:

Smart cars are a great example of how IoT is used for controlling, monitoring, and driving a car with the help of a smart-phone / any other smart device through integrated sensors and a central computer installed in the car.

Manufactures also use such sensors to know about their supply-chain and hence attach a sensor in the vehicle that transports their goods. Even taxis works based on this IoT application, in order to pick-up / drop their customers from and in their desired destinations, respectively. One can also get these sensors to usage while trying to park their smart car in their garage.



9. Smart Grid:

These grids of IoT are also known as Power / Intelligent grids as they brilliantly manage the power resources by keeping a regular/automated check on the supply and demand of energy/electricity.

It's transmission, consumption, distribution, and generation are all identified and monitored. This leads to an increase in the economics and efficiency of electricity/energy. The Solar Panel is



one of the best examples of a smart grid.

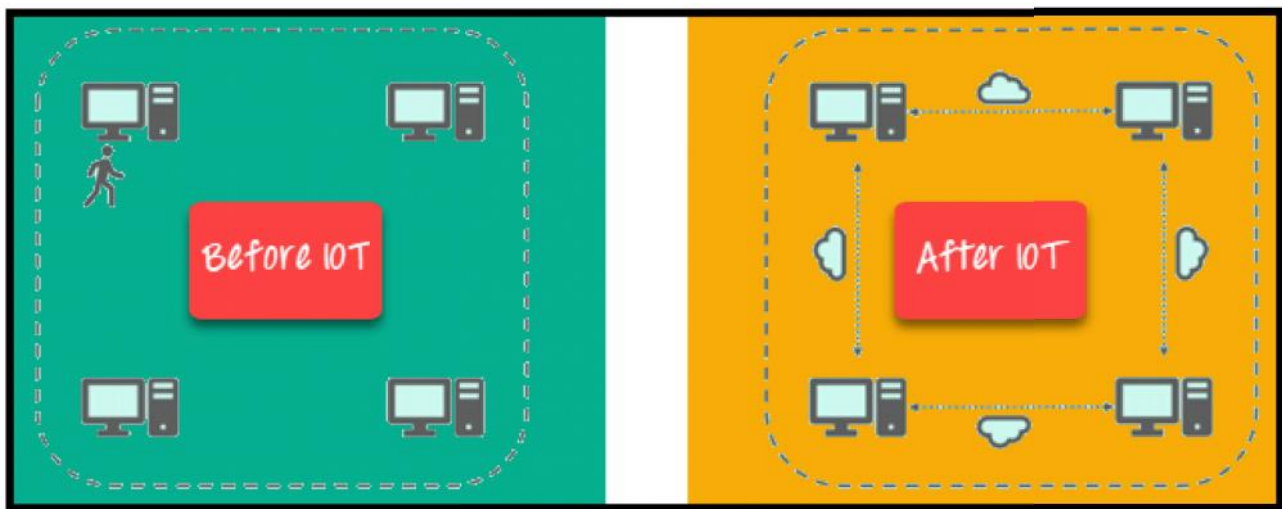
10. Wearable:

Wearable refer to the smart-watches produced by Apple, Motorola, and others, Myo Gesture Control, the Look-See bracelet, and many more which work with a sensor and software. They are used by the users to know about themselves for development and enhancement.

Wearable can be used by users for fitness, entertainment, GPS, and also other health purposes. However, the energy/power released or used by IoT in these wearables are very less and thus they do not affect the users.



IoT – Advantages



The advantages of IoT span across every area of lifestyle and business. Here is a list of some of the advantages that IoT has to offer –

- **Improved Customer Engagement** – Current analytics suffer from blind-spots and significant flaws in accuracy; and as noted, engagement remains passive. IoT completely transforms this to achieve richer and more effective engagement with audiences.
- **Technology Optimization** – The same technologies and data which improve the customer experience also improve device use, and aid in more potent improvements to technology. IoT unlocks a world of critical functional and field data.
- **Reduced Waste** – IoT makes areas of improvement clear. Current analytics give us superficial insight, but IoT provides real-world information leading to more effective management of resources.
- **Enhanced Data Collection** – Modern data collection suffers from its limitations and its design for passive use. IoT breaks it out of those spaces, and places it exactly where humans really want to go to analyze our world. It allows an accurate picture of everything.

IoT – Disadvantages

Though IoT delivers an impressive set of benefits, it also presents a significant set of challenges. Here is a list of some its major issues –

- **Security** – IoT creates an ecosystem of constantly connected devices communicating over networks. The system offers little control despite any security measures. This leaves users exposed to various kinds of attackers.

- **Privacy** – The sophistication of IoT provides substantial personal data in extreme detail without the user's active participation.
- **Complexity** – Some find IoT systems complicated in terms of design, deployment, and maintenance given their use of multiple technologies and a large set of new enabling technologies.
- **Flexibility** – Many are concerned about the flexibility of an IoT system to integrate easily with another. They worry about finding themselves with several conflicting or locked systems.
- **Compliance** – IoT, like any other technology in the realm of business, must comply with regulations. Its complexity makes the issue of compliance seem incredibly challenging when many consider standard software compliance a battle.

The Future of the Internet of Things

So, considering the above, just what does the future have in store for the Internet of Things?

- IoT is the new trendsetter in today's world due to its amazing and advanced applications which makes life easier for both individuals and entrepreneurs. With such demand, the scope of IoT in the upcoming days will also be more as there will be more smart homes, retails, and cities.
- A Gartner report predicts that connected devices across all manner of technologies will hit 20.6 billion. That number could hit 1 trillion by 2025, according to HP, and that's just a staggering figure. According to a Cisco report, the next decade will see IoT devices creating \$14.4 trillion worth of value across several industries like the ones mentioned above.
- In other words, the Internet of Things is poised to create life-changing conditions in our lives, both in a professional and personal capacity. Many of the innovations mentioned are already in place to one extent or another. One thing's for sure: there's no going back. The IoT offers an unprecedented degree of control and efficiency that no industry can ignore.
- What does that mean for you? The Internet of Things, and its association with technologies such as ITIL, Blockchain and Big Data, is a lucrative field with lots of potential for careers.

Conclusion

Internet of Things / IoT is a platform that connects the virtual world to real-time life by means of RFID, sensors, Artificial Intelligence, connectivity, and communicating devices. All this helps a person better their lives and also aids a firm to uplift their business practices. However, the need for IoT will only increase over the years as men and women want a life that's better than the one they had a day before and IoT will only improve one's lifestyle. It will also contribute to a better economy of the state and the firms. Therefore, IoT is not just a mere invention to communicate without human interference but is a means of life itself.

Blockchain Technology

Madhurima Santra

LECTURER, DETCE

Blockchain is a system of recording information in a way that makes it difficult or impossible to change, hack, or cheat the system.



A blockchain is essentially a digital ledger of transactions that is duplicated and distributed across the entire network of computer systems on the blockchain. Each block in the chain contains a number of transactions, and every time a new transaction occurs on the blockchain, a record of that transaction is added to every participant's ledger. The decentralised database managed by multiple participants is known as Distributed Ledger Technology (DLT).

Blockchain is a type of DLT in which transactions are recorded with an immutable cryptographic signature called a hash.

Why is blockchain important?

Traditional database technologies present several challenges for recording financial transactions. For instance, consider the sale of a property. Once the money is exchanged, ownership of the property is transferred to the buyer. Individually, both the buyer and the seller can record the monetary transactions, but neither source can be trusted. The seller can easily claim they have not received the money even though they have, and the buyer can equally argue that they have paid the money even if they haven't.

To avoid potential legal issues, a trusted third party has to supervise and validate transactions. The presence of this central authority not only complicates the transaction but also creates a single point of vulnerability. If the central database was compromised, both parties could suffer.

Blockchain mitigates such issues by creating a decentralized, tamper-proof system to record transactions. In the property transaction scenario, blockchain creates one ledger each for the buyer and the seller. All transactions must be approved by both parties and are automatically updated in both of their ledgers in real time. Any corruption in historical transactions will corrupt the entire ledger. These properties of blockchain technology have led to its use in various sectors, including the creation of digital currency like Bitcoin.

What are the features of blockchain technology?

Blockchain technology has the following main features:

Decentralization

Decentralization in blockchain refers to transferring control and decision making from a centralized entity (individual, organization, or group) to a distributed network. Decentralized blockchain networks use transparency to reduce the need for trust among participants. These networks also deter participants from exerting authority or control over one another in ways that degrade the functionality of the network.

Immutability

Immutability means something cannot be changed or altered. No participant can tamper with a transaction once someone has recorded it to the shared ledger. If a transaction record includes an error, you must add a new transaction to reverse the mistake, and both transactions are visible to the network.

Consensus

A blockchain system establishes rules about participant consent for recording transactions. You can record new transactions only when the majority of participants in the network give their consent.

What are the key components of blockchain technology?

Blockchain architecture has the following main components:

A distributed ledger

A distributed ledger is the shared database in the blockchain network that stores the transactions, such as a shared file that everyone in the team can edit. In most shared text editors, anyone with editing rights can delete the entire file. However, distributed ledger technologies have strict rules about who can edit and how to edit. You cannot delete entries once they have been recorded.

Smart contracts

Companies use smart contracts to self-manage business contracts without the need for an assisting third party. They are programs stored on the blockchain system that run automatically when predetermined conditions are met. They run if-then checks so that transactions can be completed confidently. For example, a logistics company can have a smart contract that automatically makes payment once goods have arrived at the port.

Public key cryptography

Public key cryptography is a security feature to uniquely identify participants in the blockchain network. This mechanism generates two sets of keys for network members. One key is a public key that is common to everyone in the network. The other is a private key that is unique to every member. The private and public keys work together to unlock the data in the ledger.

For example, John and Jill are two members of the network. John records a transaction that is encrypted with his private key. Jill can decrypt it with her public key. This way, Jill is confident that John made the transaction. Jill's public key wouldn't have worked if John's private key had been tampered with.

How does blockchain work?

While underlying blockchain mechanisms are complex, we give a brief overview in the following steps. Blockchain software can automate most of these steps:

Step 1 – Record the transaction

A blockchain transaction shows the movement of physical or digital assets from one party to another in the blockchain network. It is recorded as a data block and can include details like these:

Who was involved in the transaction?

What happened during the transaction?

When did the transaction occur?

Where did the transaction occur?

Why did the transaction occur?

How much of the asset was exchanged?

How many pre-conditions were met during the transaction?

Step 2 – Gain consensus

Most participants on the distributed blockchain network must agree that the recorded transaction is valid. Depending on the type of network, rules of agreement can vary but are typically established at the start of the network.

Step 3 – Link the blocks

Once the participants have reached a consensus, transactions on the blockchain are written into blocks equivalent to the pages of a ledger book. Along with the transactions, a cryptographic hash is also appended to the new block. The hash acts as a chain that links the blocks together. If the contents of the block are intentionally or unintentionally modified, the hash value changes, providing a way to detect data tampering.

Thus, the blocks and chains link securely, and you cannot edit them. Each additional block strengthens the verification of the previous block and therefore the entire blockchain. This is like stacking wooden blocks to make a tower. You can only stack blocks on top, and if you remove a block from the middle of the tower, the whole tower breaks.

Step 4 – Share the ledger

The system distributes the latest copy of the central ledger to all participants.

What are blockchain protocols?

The term blockchain protocol refers to different types of blockchain platforms that are available for application development. Each blockchain protocol adapts the basic blockchain principles to suit specific industries or applications. Some examples of blockchain protocols are provided in the following subsections:

Hyperledger fabric

Hyperledger Fabric is an open-source project with a suite of tools and libraries. Enterprises can use it to build private blockchain applications quickly and effectively. It is a modular, general-purpose framework that offers unique identity management and access control features. These features make it suitable for various applications, such as track-and-trace of supply chains, trade finance, loyalty and rewards, and clearing settlement of financial assets.

Ethereum

Ethereum is a decentralized open-source blockchain platform that people can use to build public blockchain applications. Ethereum Enterprise is designed for business use cases.

Corda

Corda is an open-source blockchain project designed for business. With Corda, you can build interoperable blockchain networks that transact in strict privacy. Businesses can use Corda's smart contract technology to transact directly, with value. Most of its users are financial institutions.

Quorum

Quorum is an open-source blockchain protocol that is derived from Ethereum. It is specially designed for use in a private blockchain network, where only a single member owns all the nodes, or in a consortium blockchain network, where multiple members each own a portion of the network.

What is the difference between a database and a blockchain?

Blockchain is a special type of database management system that has more features than a regular database. We describe some significant differences between a traditional database and a blockchain in the following list

Blockchains decentralize control without damaging trust in the existing data. This is not possible in other database systems.

Companies involved in a transaction cannot share their entire database. But in blockchain networks, each company has its copy of the ledger, and the system automatically maintains consistency between the two ledgers.

Although in most database systems you can edit or delete data, in blockchain you can only insert data.

How is blockchain different from the cloud?

The term cloud refers to computing services that can be accessed online. You can access Software as a Service (SaaS), Product as a Service (PaaS), and Infrastructure as a Service (IaaS) from the cloud. Cloud

providers manage their hardware and infrastructure and give you access to these computing resources over the internet. They provide many more resources than just database management. If you want to join a public blockchain network, you need to provide your hardware resources to store your ledger copy. You could use a server from the cloud for this purpose too. Some cloud providers also offer complete Blockchain as a Service (BaaS) from the cloud.

What is Blockchain as a Service?

Blockchain as a Service (BaaS) is a managed blockchain service that a third party provides in the cloud. You can develop blockchain applications and digital services while the cloud provider supplies the infrastructure and blockchain building tools. All you have to do is customize existing blockchain technology, which makes blockchain adoption faster and more efficient.

What are the benefits of blockchain technology?

Blockchain technology brings many benefits to asset transaction management. We list a few of them in the following subsections:

Advanced security

Blockchain systems provide the high level of security and trust that modern digital transactions require. There is always a fear that someone will manipulate underlying software to generate fake money for themselves. But blockchain uses the three principles of cryptography, decentralization, and consensus to create a highly secure underlying software system that is nearly impossible to tamper with. There is no single point of failure, and a single user cannot change the transaction records.

Improved efficiency

Business-to-business transactions can take a lot of time and create operational bottlenecks, especially when compliance and third-party regulatory bodies are involved. Transparency and smart contracts in blockchain make such business transactions faster and more efficient.

Faster auditing

Enterprises must be able to securely generate, exchange, archive, and reconstruct e-transactions in an auditable manner. Blockchain records are chronologically immutable, which means that all records are always ordered by time. This data transparency makes audit processing much faster.

Conclusion:

The blockchain technology uses decentralized network architecture to maintain its network. This means that block chaining is not centrally controlled by any corporation or agency but is a decentralized network, which makes it more secure. According to Block Chain Council, the term “Blockchain Technology” usually refers to the transparent, trustless, publicly accessible ledger that allows us to securely and quickly transfer the ownership of units of value by means of public key encryptions and proof of work methods. The purpose of blockchain is to establish and govern minimum standards, to develop measurements and inform the public if an individual meets or exceeds the minimum standard.

Arm Based Embedded Web Server

Antara Banerjee Bhowmick

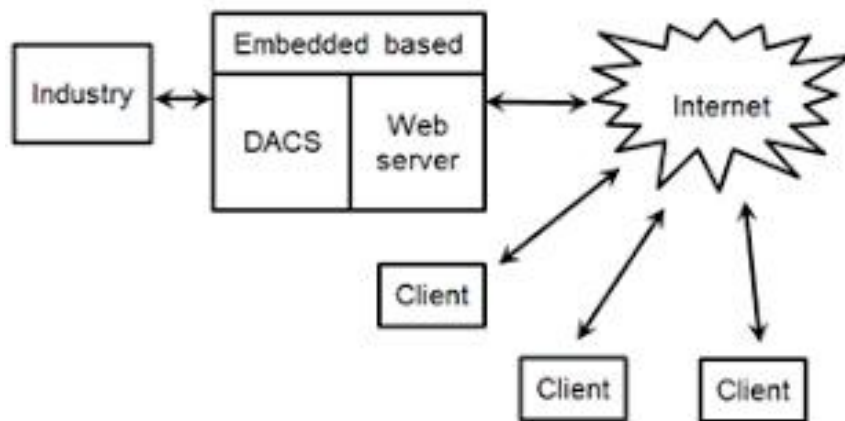
LECTURER, DETCE

Embedded systems are specialized computer systems designed and optimized to perform a particular task. Usually they are a part of a larger system or a machine. In today's world, embedded systems are everywhere: homes, offices, cars, factories, hospitals, planes and consumer electronics. They span all aspects of modern life and examples of their use are numerous.

Modern embedded systems are able to connect to the internet and can be remotely maintained and diagnosed. M2M (Machine to machine) communication is growing with a considerable rate. The possibility to connect two or more embedded systems enables developers to build more powerful distributed systems such as networked embedded systems. Remote maintenance is performed by different communication protocols. The most common communication protocol is HTTP which enables remote system control and monitoring.

A web server is a computer program that implements HTTP protocol. It accepts HTTP requests from clients like web browsers and serves HTTP responses which are usually HTML pages with linked objects. There are many web servers available, and a number of them are free, like Apache, AOL, Roxen. Internet Information Services, Sun Java System web Server are some of the most common commercial web servers. Some web servers can run on almost any operating system while others are platform specific.

The general purpose web servers are intended to run on powerful server computers, workstations or personal computers and support a number of advanced features. On the other hand, web servers for embedded systems have limited resources and offer only a set of required features.



This project implements an EMBEDDED WEBSERVER with networking capability using ARM microcontroller. Various Analog Sensors can be connected to the ARM Board. The project includes complete implementation of an HTTP Web Server in an ARM7 microcontroller. The websites are stored inside the program space of the ARM7 microcontroller and features a flexible pattern parsing algorithm. This supports using

Using any standard web browser on any PC you can access the web pages performing a variety of operations like viewing a temperature plot of the last 24 hours, control the servo motor, read/write any I/O pin by using a simple mouse-click, upload any file to the Data Flash storage and access files stored on the flash. The web server implements ARP, IP, TCP, UDP, HTTP (server), NTP (client), servo control, I/O Pin control, 2nd software UART etc.

This system is very suitable for acquiring data or signals from a large scale industry field. Hundreds of such terminals can be grouped within a network. One PC is enough for monitoring many terminals. Link

from server to the internet can be also established to realize remote monitoring. You can see the data in the office, even at home if you have internet access. This system can also be integrated into ERP system, which will improve management level access. This system will not only be useful in industry field, but also has great future in smart-house applications, networked lighting control system and other distributed control systems.

Features

- The ARM7TDMI controller is a member of the Advanced RISC machine family of general purpose 32-bit microcontroller.
- 16/32-bit ARM7TDMI-S microcontroller in a tiny LQFP64 or HVQFN package
- ARM7 - 32-bit Advanced RISC Machine
- T - Thumb architecture extension
- Two separate instruction sets, 32-bit ARM instructions and 16-bit Thumb instructions
- D - Debug extension
- M - Enhanced multiplier
- I - Embedded ICE macro cell extension
- Von Neumann Architecture
- 3-stage pipeline
- -fetch, decode, execute
- 32-bit Data Bus
- 32-bit Address Bus
- 37 32-bit registers
- 32-bit ARM instruction set
- 16-bit THUMB instruction set
- 32x8 Multiplier
- Barrel Shifter.
- 8/16/32kB of on-chip static RAM and 32/64/128/256/512kB of on-chip flash program memory. 128-bit wide interface/accelerator enables high-speed 60MHz operation.
- One (LPC2131/32) or two (LPC2134/36/38) 8-channel 10-bit ADCs provide a total of up to 16 analog inputs, with conversion times as low as 2.44 μ s per channel.
- Single 10-bit DAC provides variable analog output (LPC2132/34/36/38).

Load Cell

A load cell is a transducer that is used to convert a force into electrical signal. This conversion is indirect and happens in two stages. Through a mechanical arrangement, the force being sensed deforms a strain gauge. The strain gauge measures the deformation (strain) as an electrical signal, because the strain changes the effective electrical resistance of the wire. A load cell usually consists of four strain gauges in a Wheatstone bridge configuration.

Load cells of one strain gauge (quarter bridge) or two strain gauges (half bridge) are also available. The electrical signal output is typically in the order of a few millivolts and requires amplification by an instrumentation amplifier before it can be used. The output of the transducer is plugged into an algorithm to calculate the force applied to the transducer.

Although strain gauge load cells are the most common, there are other types of load cells as well. In industrial applications, hydraulic (or hydrostatic) is probably the second most common, and these are utilized to eliminate some problems with strain gauge load cell devices.

As an example, a hydraulic load cell is immune to transient voltages (lightning) so might be a more effective device in outdoor environments

Functionality Principal Of A Web Server

Simplified a Web server can be imagined like a special kind of a file server. . The Web server receives a HTTP GET-request from the Web browser. By this request, a specific file is required as answer . After that ,the Web server tries to get access on the file system of the requested computer. Then it attempts to find the desired file (step 2). After the successful search the Web server read the entire file (step 3) and transmit it as an answer (HTTP response comprising of header and content object) to the Web browser (step 4). If the Web server cannot find the appropriate file in the file system, an error message (HTTP response which only contains the header) is simply be send as response to the client.

The web content is build by individual files. The base is build by static files with HTML pages. Within such HTML files there are references to further files embedded –these files are typically pictures in GIF or JPEG format. However, also references to other objects, for example Java-Applets, are possible. After a Web browser has received a HTML file of a Web server, this file will be evaluated and then searched for external references. Now the steps 1 to 4 from picture 2.A will run again for every external reference in order to request the respective file from the corresponding Web server. Please note, that such a reference consists of the name or IP address of a Web server (e.g. "dilnetpc.com"), as well as the name of the desired file (e.g. "picture1.gif"). So virtually every reference can refer to another Web server.

In other words, a HTML file could be located on the server "ssv-embedded.de" but the required picture - which is external referenced by this HTML file- is located on the Web server ."dilnetpc.com". Finally this (worldwide) networking of separate objects is the cause for the name World Wide Web (WWW). All files, which are required by a Web server, are requested from a browser like the procedure shown on picture 2.A.

Normally these files are stored in the file system of the server. The Webmaster has to update these files from time to time .A further elementary functionality of a Web server is the Common Gateway Interface (CGI) -we have mentioned before. Originally this technology is made only for simple forms, which are embedded into HTML pages. The data, resulting from the padding of a form, will be transmitted to a Web server via HTTP-GET or POST-request (see step 1 into picture 2.B).

In such a GET- or POST-request the name of the CGI program, which is needed for the evaluation of a form, is fundamentally included. This program has to be on the Web server. Normally the directory "/cgi-bin" is used as storage location. As result of the GET- or POST request the Web server starts the CGI program located in the subdirectory "/cgi-bin" and delivers the received data in form of parameters (step 2). The outputs of a CGI program are guided to the Web server (step 3). Then the Web server sends them all as responses to the Web browser

Conclusion and Future Scope

Hence, the “ARM BASED EMBEDDED WEB SERVER” seminar report is completed satisfactorily with mentioned literature survey and required completion of project as per the Academic Schedule of Pune University.

RedTacton Technology

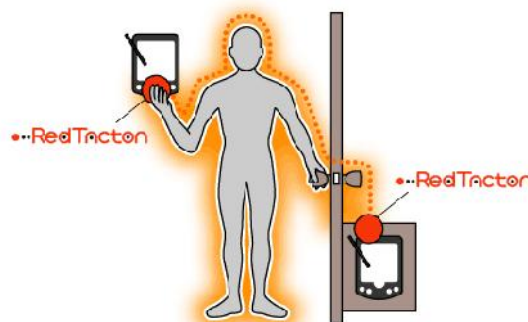
Vivek Das

TECHNICAL ASSISTANT, DEITCE

INTRODUCTION

RedTacton Technology is a concept that refers to the transmission of signals at very high speeds through the human body. Just like the Bluetooth Technology, this concept is also known to be wireless in nature. The transmitter and receiver used in RedTacton and is explained with the help of a figure. Some interesting features of the technology like touch, media, and broadband are also explained with an image. Its applications and comparison with other wireless technologies like w-fi, RFID, Bluetooth, and W-CDMA are also explained.

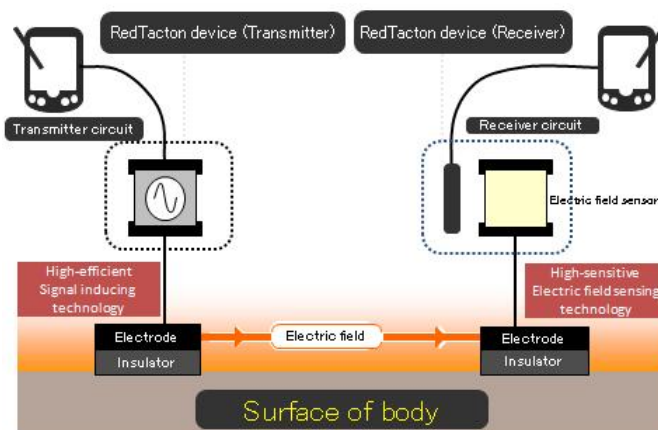
Now, researchers are trying to develop a new path for transmission of signals called Human Area Networking. As the name indicates, such a technology will have the human body surface to transmit and receive signals at very high speeds. Now we are going to discuss such a technology, which is currently under development, called RedTacton Technology.

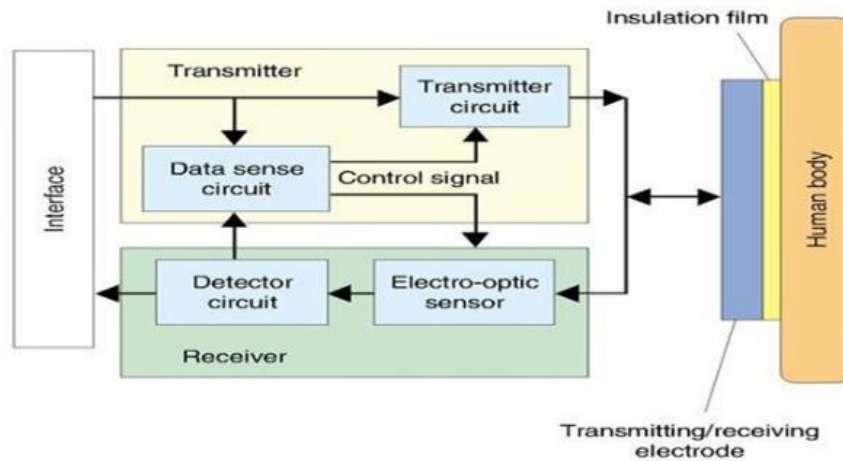


According to science studies, we know that our body is creating minute electric charges all the time. This electric field thus created is used for RedTacton technology to transmit and receive [duplex communication] the signals. Thus, this method is completely different from other signal transmitting technologies like wireless and infrared. Thus, like LAN and WAN, a new network protocol called HAN [Human Area Network], is being configured.

How RedTacton Works?

- Similar to any other technology, RedTacton Technology, will also have a transmitter and a receiver.
- As soon as the human body comes in contact with the RedTacton transceiver, the signals will start to be transmitted. When the contact is taken off, the transmission will also stop.
- The terminals are either embedded in the devices or are carried by the user itself. According to the natural and physical movements of the user, the communication will happen in various combinations.
- The communication through the user can occur only through his body surface parts like hands, fingers, arms, feet, face, legs or torso. The technology also works in shoes and other clothing's as well.
- The transmitter in RedTacton will induce a mild electric field on the human body surface. A transistor or photonic electric field sensor will be setup as the sensor for the electric field on the RedTacton receiver. This sensor detects the electric field and the signal will be processed in the receiver as well.
- This processed signal thus becomes the data that is to be downloaded.





BASIC BLOCK DIAGRAM OF A REDTACTON TRANSCEIVER

- Like digital signals, the signals will depend on the fluctuations in the electric field that is induced in the body. As the electric field is mild in nature, highly sensitive sensing technology is used in the receiver part.
- Other than the electric field that transmits the data, there will also be very small and unstable electric fields on the surface of the body. This will be natural in nature and will be automatically sent back to earth.

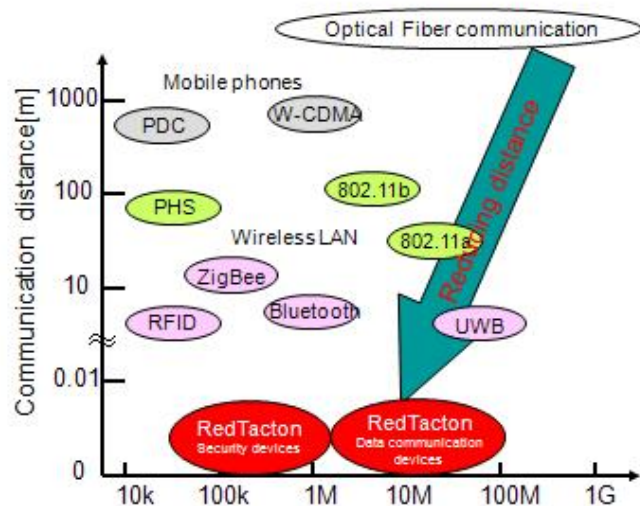
Comparison with other network technologies

Take a look at the figure below. The chart displayed shows the exact position of RedTacton with the other network technologies that are available today.

RedTacton actually is helpful in short distance communication. When compared with a wi-fi communication, this technology seems advantageous. In Wi-Fi, there is no need of any physical connections. Thus communication is established as soon as the signals arrive. But, when it comes to security reasons, Wi-Fi is a problem. As the signals can be easily hacked by others, extra security measures have to be included.

Also, when compared with wired transmission, RedTacton is more advantageous. Here physical connection is required at a high rate for data transmission. With more and more users trying to retrieve data from a single source, the physical connections become a problem. But, there will not be many problems with security.

So, we can confirm that RedTacton technology comes right in between wireless and wired connection. It can provide maximum security as well as data transfer without the use of physical connections. The security will be maximum as the data transfers can occur only between two contact points. Take a look at the figure below to know the exact comparison between all the technologies.



RedTacton Features

Here are some of the main features of this technology.

- Touch Feature

In this technology, every mode of communication can be done with a touch. All physical movements like touching, gripping, sitting, walking, stepping and so on are used as triggers for various processes of the equipment. The processes can be the START and STOP of the equipment, data retrieval or even locking and unlocking.

- Broadband Feature

For broadband communication, the ideal speed with this method is said to be 10 Mbps. This is constant for full duplex communication. Even if multiple communications is used through this technology, the speed will not be affected as the signal is transmitted through the human body.

Application of RedTacton

If you want to listen to music from your MP3 player, you will have to adjust the headphone to your ears and then switch on the player that is kept in your pocket. But, with this technology, since there are no wires, the digital signals can be passed from your player to the headphone through your body, clothes, and shoes and so on. To play the next song or to adjust the settings you can do it by selecting one of the touching features as explained above.

If you want to send the photos that are stored in your camera to a laptop, all you have to do is make a contact between the laptop and the camera.

Other amazing applications also includes the sending of business cards to each other just by a shake hand, exchange telephone numbers while you are dancing, sending e-mails with a touch and so on.

Battery Less Phones

NAME-POULOMI DAS, 3RD YEAR, DETCE

Abstract

If we just date back to January 9, 2007, it's the date when the world first witnessed a smart phone, and in fact, the first 'Touch screen phone'. Mr. Jobs, the owner of Apple Inclusive launched the "I-phone" aiming to turn everyone's life uncomplicated. And then, it has been ten years since the launch of the smart phone, and in these 10 years, the world has observed a revolutionary change in the era of smart phones. One of the most drastic changes was witnessed in the batteries of these smart phones, ranging from 1000mAh to 5000mAh on an average. In the past couple of years, intense usage of smart phones for various purposes has resulted in battery draining at a rapid rate.

Many types of research have been done in order to find the exact reason for the battery drain at a rapid rate and its solutions, although none of them were able to accomplish anything special, and hence, rather than to find a solution to battery's long life, a different solution was established, and it was to construct phones, which can be operated without batteries. This research paper focuses on the implementations of "Battery Less Smart phones", and on its pros and cons. It will also state some of the economic and possible changes that can be made as per our research.

Introduction

The smart phones we are using these days are indeed smart, however, are they really that smart as the companies claim? The answer to this question is yes, but aren't those really dumb if discussed in terms of battery life? Yes, they are. Even the companies that sell smart phones at phenomenal rates have the issue of battery's performance [1]. The performance is better as compared to others, but it is still a mystery if discussed in terms of long life. The idea of battery less smart phones was initiated by a group of researchers from "The University of Washington", who invented the phone with a dial pad, and to the next level of astonishment, the phone was designed so that it could harvest energy from "Radio Signals". The phone developed, features a dial pad, a small led light, and will also include an E-ink display.

A. Perspective for Battery Less Phones

A lot of discrepancies about the battery's performance were going on around the world. The issue about the battery's anomalous drain lead to the research of innovative stuff, which furthermore lead to the invention of these Battery Less Mobiles. Smart Phones these days are a real help for the human race, the way they are used to reduce our burden and anxiety by saving our time is just unexplainable, And to the fact that everyone knows about the battery affair, people still purchase phones to stay connected to the world, and hence, these battery less phones were created to replace the battery's draining issue and to offer an effective method of staying connected to the world.

B. Battery Less Smart Phones Vs Battery Saving Applications

The multi task calculating apps can increase your battery's life, but to a very small extent. These apps maintain your phone's battery life by clearing other apps from the background and by suggesting you the precautions about how to use your phones effectively, but battery less phones are way different as the battery doesn't exist and hence they will be greatly helpful in the future, especially for upcoming generations [3]. So, this paper will completely focus on the methods about how to implement the technology as soon as possible and what could be the effective changes in it.

Framework for Battery Free Phones

PlayUnmute

Fullscreen

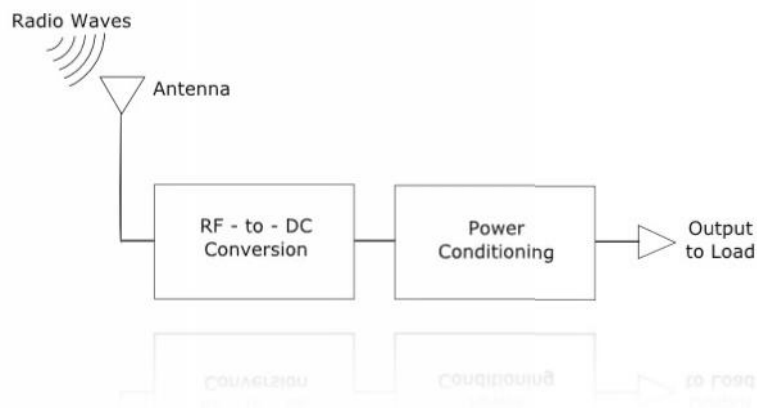
VDO.AI

ambient sources, and surprisingly those ambient sources are "Radio Signals or Radio Waves", and the device uses a minute photo diode to harvest energy from the ambient light or RF sources. It consumes only 3.5 microwatts of power from these energy sources. The device has a limited range of just 31 feet from the base station and the range can be expanded to 50 feet with the help of a small "Solar Cell".

A. Procedure for Fetching Energy from Ambient Sources

1. Harnessing Energy

In order to harness energy from the ambient sources, a base station is required and the base station is placed as per the range specified(31feet-50feet), RF energy can be transmitted in unlicensed bands or grids ranging from 868MHz to 5.4GHz from their respective base stations. It is then, that this RF energy is transfigured into DC power through some energy harnessing devices such as "Powercast'sPowerharvester Receivers", these receivers also contain criterion or conventional antennas having an average resistance of 40-50 ohms.



The main feature of these harvesters is to maintain the effectiveness while maintaining the disparities of RF to DC transfiguration in order to make the output stable, Although heading with the new technology of battery free phones, the procedure was way different as compared to the described one. In the phone, a "photo diode" was used to convert the ambient light into current or DC power. These photo diodes can also produce energy in absence of light as they contain optical filters and in-built lenses to perform better in dark conditions.

2. Conversion of Ambient Signals to Power with the Photo Diode

The researchers at the University easily found the fact that using a photo diode for converting ambient signals and light into current is much efficient and economical than installing a power harvester since the amount of power required for the functioning of the prototype was very less. A Photodiode is a semiconductor, with p-n junction diode and an intrinsic layer between two junctions [8]. The photocurrent is provoked by the electron hole pair because of the assimilation of light between depletion region. When photons of energy greater than 1.1 electron volt (eV) strike the diode, electron-hole pairs are originated. The potency of photon absorption depends on the energy of photons – the lower the energy of photons, the deeper the assimilation is. If the absorption occurs in the depleted region of the p-n junction, these hole pairs are wiped from the junction - due to the inbuilt electric field of the depletion region. Hence, the holes proceed toward the anode and the electrons move toward the cathode, thereby generating photocurrent. The sum of photocurrents and dark currents, which flow with or without light, is the amount of current progressing through the photodiode, And this is how a small amount of power is generated in the battery less phone with the assistance of a tiny photo diode

Prototype & Working of Battery Less Smart Phones

In the given model, the user undertakes a button to twig in between the two transmitting and listening notes. The team of researchers utilized the shell components on a printed circuit board and the team corroborated and ensured that the battery free prototype can perform basic functions like calling someone up and then hanging up the call without any inadequate call drops. A custom base station collects the data in form of digital packages with the help of a “Backscatter” and connects our call through “Skype” and the person at the other end answers the call and responds. The device inherits the signals with a technology referred as “Zero Power Amplitude Modulation” and plants the audio onto the earphones. For making a call, the user has to dial the number on the dial pad and has to speak into the microphone. For attending the call at receiver’s end, the user has to pick up the call and respond, the call is transported to a long distance with a backscatter, which helps in the cycling of data packages.

A. Shell Component and its Working

The Shell, which is used with the Kernel (part of operating system), is a part of the operating system of the battery free device that is utilized for recasting the Human made programming into the machine language. When the user enters the command for executing any sort of operation, the request proceeds to the shell parts, also known as Interpreter which then translates the code and transfers it to the Kernel [11], the kernel then receives and accepts the request and exhibits it on to the display area or screen. The kernel also provides memory for the running processes on the prototype.

B. How is Power Saved?

If we head back again towards the mobiles and devices of today’s generation, the phenomenon behind the battery’s hunger for power is the process of converting analog signals into digital data packages that a phone can interpret. This process consumed the highest amount of power in smart phones that we are operating at present, however that’s not the case with battery free cell phones as the battery free prototype takes the dominance of minute vibrations that occur in the phone’s microphone and speaker when the user speaks into the microphone or listens to an incoming call. An antenna connected to the shell and speaker components receives the analog radio signals, which are emitted by the cellular base station and then these signals are transmitted back to the cellular base station by the use of a

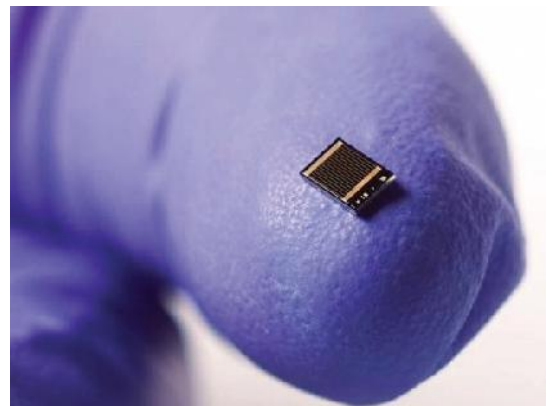
“backscatter” in order to maintain a cycle of transferring digital packages that furthermore helps in retaining signal strength so that the call doesn’t hang up in an insufficient manner.

Backscatter-Working and Performance

A backscatter is a device that reflects or deviates any particle through an angle measure of approximately 180 degrees. RFID (Radio Frequency Identification) backscattering is a technology which uses the RF power transmitter in accordance to the tag reader to vitalize the tag(objects that are to be identified). Necessarily, they “deviate” part of the power conveyed by the reader, although it affects some of the properties, and in this manner, it sends backs information to the reader. With the help of RFID backscatter, some tags obtain their data transmission by converting the properties of the tags themselves, where as the rest twig between a load resistor in and out of the antenna circuit [13]. RFID backscatter conversion controls outside the field region, and the radio signal proliferates away from the RFID reader. When the signal approaches the RFID tag, this inter communicates with the ongoing signal and some energy is deviated towards the RFID reader [14]. Over momentary ranges, the quantity of power outstretching the tag from the reader is quite enough to allow operation of low current circuits inside the tag, and so even with these low currents, the battery less device was able to reflect digital data packages.

How do solar cell work and increases range by saving energy?

Solar cell constitutes of P-N junction diode, which is assembled from Silicon and Germanium. With the help of vapor deposition, P type layer is diffused over N type semiconductor with p type having some electrodes. This process constructs open space for light to fall on P layer and hence underlying the P-N junction [22]. The bottom of N layer comprises of current assembling electrode. When a light photon arrives at the junction, they exhilarate electrons from valence band to conduction band, discarding behind an equal number of holes in the valence band.



This electron hole generated in the depletion region accelerates in opposite direction because of the barrier field. Photo generated electrons accelerate in direction of n type and electrons directed towards p side. The hoard of these charges carriers formulates p side, a positive electrode, and N side, a negative electrode. Hence photo voltage is set up across the junction. When load resistance is connected in the circuit, the current flows through the solar cell [23]. This current from the solar cell is greater than that produced by the RF signals and hence a reason ,the capacity of backscatter increases in order to send digital packages back to the base station, and finally the range increases

Advantages

The advantages of this battery-less phones are exceptional, though the implementation of these phones completely, is still a mystery. From saving energy to utilizing new technology, this outstanding prototype stands rigidly in every part of the platform, when it comes to energy saving.

A. Conserves Electricity

Since the phone doesn’t consist of a battery, it saves electricity to a great amount. As per a survey, it approximately costs a person around 5\$ a year to charge a phone. The amount may not seem that big,

but it increases to 500 \$ for 10 years and around 5000\$ in a century. So now it can be easily figured that battery less phone can save electricity and money by large amounts.

B. Saves Time

From some of the latest facts and figures, it was estimated that a person usually spends approximately 2.5 hours in a day while waiting for the phone to charge. The amount of time increases to around 1000 hours in a year.

c. Low Power Consumption

As explained earlier, the battery free cell-phone consumes only 3.5 microwatts of power, which is captured from ambient power sources. On an average, it was found that charging your phone consumes 1kWh of power in a year. The power is quite low as compared to the time period of one year, Although if we imagine that if a normal mobile with battery consumes this much power, then how many years would it take for a battery less cell phone to use 1kWh of power? The answer goes even beyond hundred thousand years, so it saves power by a huge amount.

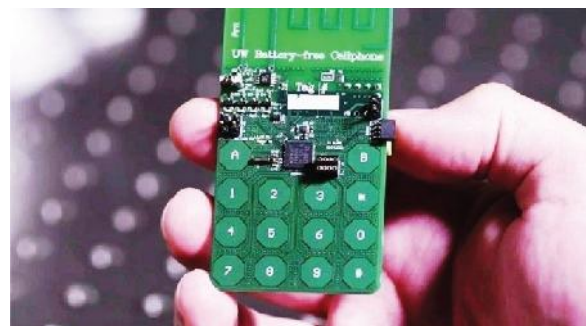
d. No Charging Issues

The fact is not hidden that charging a phone, again and again, annoys a person, the most. Charging a phone completely and plugging it once more after using it for some hours, displeases the user in emergency and crucial situations. With the battery less phone, anyone can operate the phone anytime and anywhere without worrying about the sudden drain of the battery.



Conclusion

It was extremely astonishing to witness that a group of researchers have finally developed a phone that uses no power, which means the phone has no battery and harnesses energy from ambient signals and light sources. Even Mr. Jobs, who designed the first ever smart phone, might have never thought that smart phones would be that smart that someday we would be able to use it without a rechargeable option, that is without a battery. The phone just consumes 3.5 microwatts of power and harvests energy from ambient radio and light sources with the help of minute diodes that convert light and signal strength into a current which is furthermore converted into few microwatts of power. With the phone, we can just dial a number and call to another person.



The phone possesses a backscatter that sends the digital packages back to the cellular base station. The base station then receives the signals and connects the call through Skype. The battery less phone obtains signals with the help of zero power amplitude modulation and transfers audio onto our earphones. To respond, the user has to press a button and speak into the microphone. Even after combining these amazing technologies, the phone has multiple disadvantages, Range being the biggest one. As per the rate of growing technology, these limitations will be fixed soon with all the Wifi routers having RF emission sources, and we would soon witness an 'Advance Battery less Phone' with multiple features.

Satellite internet connection

Muskan singh, 3rd year DETCE

Satellite Internet generally relies on three primary components: a satellite – historically in geostationary earth orbit (or GEO) but now increasingly in low earth orbit (LEO) or medium earth orbit (MEO) – a number of ground stations known as gateways that relay Internet data to and from the satellite via radio waves (Microwave), and further ground stations to serve each subscriber, with a small antenna and transceiver. Other components of a satellite Internet system include a modem at the user end which links the user's network with the transceiver, and a centralized network operation system (NOC) for monitoring the entire system. Working in concert with a broadband gateway, the satellite operates a star network topology where all network communication passes through the network's hub processor, which is at the centre of the star. With this configuration, the number of ground stations that can be connected to the hub is virtually limitless. Marketed as the centre of the new broadband satellite networks are a new generation of high-powered GEO satellites positioned 35,786 kilometres (22,236 mi) above the equator, operating in K_a-band (18.3–30 GHz) mode. These new purpose-built satellites are designed and optimized for broadband applications, employing many narrow spot beams, which target a much smaller area than the broad beams used by earlier communication satellites. This spot beam technology allows satellites to reuse assigned bandwidth multiple times which can enable them to achieve much higher overall capacity than conventional broad beam satellites. The spot beams can also increase performance and consequential capacity by focusing more



power and increased receiver sensitivity into defined concentrated areas. Spot beams are designated as one of two types: subscriber spot beams, which transmit to and from the subscriber-side terminal, and gateway spot beams, which transmit to/from a service provider ground station. Note that moving off the tight footprint of a spotbeam can degrade performance significantly. Also, spotbeams can make the use of other significant new technologies impossible, including 'Carrier in ' modulation. In conjunction with the satellite's spot-beam technology, a bent-pipe architecture has traditionally been employed in the network in which the satellite functions as a bridge in space, connecting two communication points on the ground. The term "bent-pipe" is used to describe the shape of the data path between sending and receiving antennas, with the satellite positioned at the point of the bend. Simply put, the satellite's role in this network arrangement is to relay signals from the end user's terminal to the ISP's gateways, and back again without processing the signal at the satellite. The satellite receives, amplifies, and redirects a carrier on a specific radio frequency through a signal path called a transponder.

VIRTUAL REALITY AND AUGMENTED REALITY

Name– Netai Chandra Porel, 3rd Year, DETCE



We spend a lot of time looking at screens these days. Computers, smartphones, and televisions have all become a big part of our lives; they're how we get a lot of our news, use social media, watch movies, and much more. Virtual reality (VR) and augmented reality (AR) are two technologies that are changing the way we use screens, creating new and exciting interactive experiences.

Virtual reality uses a headset to place you in a computer-generated world that you can explore. Augmented reality, on the other hand, is a bit different. Instead of transporting you to a virtual world, it takes digital images and layers them on the real world around you through the use of either a clear visor or smartphone. With virtual reality, you could explore an underwater environment. With augmented reality, you could see fish swimming through the world around you.

▪ Virtual reality

Virtual reality immerses you in a virtual world through the use of a headset with some type of screen displaying a virtual environment. These headsets also use a technology called head tracking, which allows you to look around the environment by physically moving your head. The display will follow whichever direction you move, giving you a 360-degree view of the virtual environment.

The system requirements for VR range from a smartphone inserted into a simple cardboard eyepiece to a self-contained headset to wearables that connect to powerful computers that do the bulk of the

processing. Regardless of the equipment involved, there is significant friction for the end user in setting up and using the technology.

Given this friction, businesses have to think carefully about where they may want to implement VR. Conferencing is a possible solution, but the benefits to a VR conference have to be weighed against the cost of the equipment and the usability. Training holds more possibilities, but again there would have to be a sizable investment in the VR training program. For some companies, the return will be worth the investment, but it may be difficult for VR to reach mass adoption.

▪ Types of VR devices

At the moment, there are two major types of headsets. Both have their pros and cons, which you'll want to consider if you're looking to purchase one.

The first type has a screen built in to the headset. These devices connect to a computer and require a pretty powerful system to operate smoothly. They have great graphics and perform well, but they're also pretty expensive. A few popular examples of these include the Oculus Rift, the Vive, and the PlayStation VR, which connects to the PlayStation 4 game console.

Some of these devices come with handheld controllers that track your hands' movements as well, providing for a more interactive experience.



The other type of headset houses your phone and uses its screen as the display. These don't require a computer and run completely off of apps on your smartphone. The graphics and performance levels on these headsets aren't quite as good as those with a built-in screen, but they do tend to be much cheaper. Some popular examples include Google Cardboard and the Gear VR.

▪ Advantages of Virtual Reality

- 1) Virtual reality creates a realistic world
- 2) It enables user to explore places.

- 3) Through Virtual Reality user can experiment with an artificial environment.
- 4) Virtual Reality make the education more easily and comfort.

▪ Disadvantages of Virtual Reality

- 1) The equipment's used in virtual reality are very expensive.
- 2) It consists of complex technology.
- 3) In virtual reality environment we cant move by our own like in the real world.

▪ Augmented reality

Augmented reality allows you to see the world around you with digital images layered on top of it. There are currently a couple of AR headsets available, including the Microsoft HoloLens and the Magic Leap. However, they are currently more expensive than VR headsets, and are marketed primarily to businesses.

Augmented reality can also be used on devices like smartphones and laptops without the use of a headset. There are a variety of apps that use AR, including some that allow you to translate text using your camera, identify stars in the sky, and even see how your garden would look with different plants. You may have even previously used AR without realizing it, while playing a game like Pokemon Go or using filters on Snapchat. Both VR and AR technologies are growing at a pretty rapid pace. Many experts predict that they'll continue to become more and more popular in the near future. As technology becomes more advanced, it'll be exciting to see how they'll be applied to both business and everyday life! VR and AR represent exciting new interfaces and engaging new applications, but there are many hurdles a business must clear in order to successfully implement this emerging technology. By learning about all the components, starting with a business need, and collaborating with business units, IT professionals can help make the right choices around this new trend.



▪ Advantages of AR

1. Enhanced Experience

One of the benefits of Augmented Reality is that it can provide an enhanced experience. This means users will be able to take their phones and hold them up in front of a certain area, such as a building or natural landmark. The app then overlays information on top of what they are seeing, providing more depth than could otherwise be seen by just looking at something without AR technology like this.

You can see buildings from different angles and determine where you are standing through enhanced maps and positioning. For example, when used for navigation purposes, perhaps one perspective shows

pedestrians crossing while another looks down onto the street below with arrows showing which direction drivers should go next.

2. AR will be Easy to Use

For mobile phone users, augmented reality is really easy to use. Just point your camera at an object, and the app will show you what it does with that particular item. So, for example, if you wanted to know how many calories are in a slice of pizza, all you would have to do is find an image of one on your screen and watch as the number pops up right next to it.

You can also look at something like furniture or clothing, so when you walk around your room or go shopping, you'll be able to see how well they fit into the space. It's easy for anyone who knows the way around their smartphone because all this information isn't just sitting there inside some clunky program; it's in fact, everywhere they look as far as the eye can see.

3. Supports Business Activities

AR is speculated to transform every business from housing to the retail market as the customers would be able to get more of the benefits and invest accordingly. Augmented Reality helps you with construction projects. The technology allows workers to identify and fix damaged parts of a building, structure or facility.

AR can also be used in the designing and remodelling processes; for instance, it is often more cost-effective than physical prototyping. This means companies have fewer upfront costs when they are designing new products. They will know what the final product looks like before manufacturing begins.

4. Educational Advantages of Augmented Reality

The pros of augmented reality include its potential as an educational tool that can provide rich content. The data is based on accurate GPS coordinates and provides navigation and directions without relying on paper maps.

Furthermore, there is greater access among students, educators and researchers to knowledge. For example, teachers can interact with students in classrooms globally while simultaneously teaching a lesson on the other side of the world using AR-enabled tools like Google Expeditions (Currently closed) or [Aurasma](#).

▪ Disadvantages of AR:-

1. Unaffordable:-

Augmented reality is expensive to create, and some AR apps are too complex for the average user. The cost of an app can range from \$0 up to around \$100k; it all depends on how complicated you want your app or advertising campaign to be.

Not everyone has much capital to invest in augmented reality (AR) technology, so only certain large organizations have this advantage. Small scale companies would also be unable to afford this technology due to higher expenses.

2. Privacy and Security Problems

Augmented Reality can cause privacy or security concerns. This is rooted in AR making it difficult to discern between what's real and what's not, thus leading to a fear of being "tricked" by an attack. For example, people using social media may be more likely to believe in false information if they're convinced their friends posted about it on Face book.

Photonics & Imaging Insider

Name-SOUMOJIT GHOSH, 2nd year, DETCE,

INTRODUCTION

The word 'Photonics' is derived from the Greek word "phos" meaning light (which has genitive case "photos" and in compound words the root "photo-" is used); it appeared in the late 1960s to describe a research field whose goal was to use light to perform functions that traditionally fell within the typical domain of electronics, such as telecommunications, information processing, etc.

Photonics as a field began with the invention of the laser in 1960. Other developments followed: the laser diode in the 1970s, optical fibers for transmitting information, and the erbium-doped fiber amplifier. These inventions formed the basis for the telecommunications revolution of the late 20th century and provided the infrastructure for the Internet.

Though coined earlier, the term photonics came into common use in the 1980s as fiber-optic data transmission was adopted by telecommunications network operators. At that time, the term was used widely at Bell Laboratories. Its use was confirmed when the IEEE Lasers and Electro-Optics Society established an archival journal named Photonics Technology Letters at the end of the 1980s.

During the period leading up to the dot-com crash circa 2001, photonics as a field focused largely on optical telecommunications. However, photonics covers a huge range of science and technology applications, including laser manufacturing, biological and chemical sensing, medical diagnostics and therapy, display technology, and optical computing. Further growth of photonics is likely if current silicon photonics developments are successful.

TWO-AXIS LASER SCAN HEAD

Aerotech Inc. (Pittsburgh, PA) has released the AGV-XPO, a high-dynamic, two-axis laser scan head that combines low-inertia, high-efficiency motors with ultra-high resolution position feedback and optimized structural dynamics to deliver rapid acceleration profiles and part-profile tracking with minimal following error. The AGV-XPO is suitable for high-throughput applications that require superior dynamic precision, minimal following error and rapid move-and-settle performance, including display processing and manufacturing; high-speed drilling cutting; electronics manufacturing; large-field and long focal length scanning; and femtosecond laser processing. These Two-Axis Galvo Scan Heads provide two-dimensional scanning in a variety of applications. Each scan head consists of a dual-axis galvo motor and mirror assembly, two servo amplifiers, and communication electronics. The moving-magnet galvanometers deliver high speed and accuracy while integrated optical position detectors ensure precise control, high linearity, and low drift. The scan head housings are compact and include industry-standard mechanical interfaces for integration into a system.



and

laser

The DCB Series Scan Heads are designed for OEM integration or easy plug-and-play operation. The system includes advanced digital signal processing (DSP) to rapidly compute and predict the exact drive impulses required to achieve small mirror movements with the fastest possible acceleration. The unit features self-tuning technology that automatically compensates for mechanical wear, extending its lifetime and eliminating issues associated with traditional analog servo filters. A detailed self-diagnosis and system check determine the operating parameters of the individual galvos, ensuring high accuracy and precise, error-free laser marking positioning

HIGH-DEF SWIR CAMERA

Attollo Engineering (Camarillo, CA) has introduced the new Phoenix HD5 SWIR Camera. The uncooled high-definition (HD) format (1280 x 1024 pixels) features the industry's smallest shortwave infrared HD sensor ultra-small 5- μm pixel pitch, which permits more pixels on with a short focal length optic. The camera captures snapshot imagery that provides high sensitivity from 1.0 μm to 1.65 μm the on-board processing offers sharpening, user-defined convolution filters, region of interest (ROI), automatic gain (AGC), and automatic exposure control (AEC). Raptor Photonics continues to push the boundaries in scientific imaging with the launch of the Ninox 640 SU, a vacuum cooled to -80°C InGaAs camera, offering ultra-low dark current for longer exposure times up to 5 minutes. Combining a low read noise of $<56\text{e}^-$ in high gain and a dark current reading of $<300\text{e}^-/\text{p/s}$ at -80°C , the Ninox Ultra is one of the most sensitive SWIR cameras available on the market and perfect for imaging weak signals using longer exposure times. It offers a resolution of 640×512 and has a $15\mu\text{m} \times 15\mu\text{m}$ pixel pitch. The camera also offers a high intra-scene dynamic range of 56dB in high gain, enabling simultaneous capture of bright and dark portions of a scene. The Ninox 640 SU follows on from the launch of the Ninox 640 and Ninox 1280 cameras, which have attracted a lot of interest in applications including astronomy and in-vivo imaging. The Ninox 640 SU is also available for sale in China and Russia.

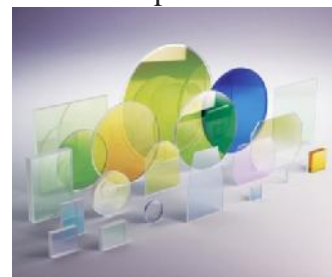


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SWIR OPTICAL FILTERS

Chroma Technology (Bellows, VT) has introduced new SWIR filters for machine vision and remote sensing. The latest additions to the ContrastMax line of optical filters are engineered for automated vision applications from the visible to SWIR. Chroma's ContrastMax filters cover a range of center wavelengths from 380 to 2800 nm and offer superior levels of contrast while blocking unwanted light. The new line of SWIR sputter-coated optical filters for remote sensing applications are designed to optimize the signal-to-noise ratio. These filters have precise center wavelengths, narrow transmission bands, exceptional flat-top transmission, and OD4 off-band blocking. PIXELTEQ's short-wave infrared (SWIR) optical bandpass filters deliver precise transmission of specific SWIR spectral bands while blocking out-of-band signals at higher and lower wavelengths. The multi-edge bandpass filters transmit wavelengths defined by a nominal center wavelength (CWL) and bandwidth (FWHM – Full Width Half Max) while reflecting both shorter and longer wavelengths. Also known as thin film or interference filters, PIXELTEQ's bandpass filters use multi-layer hard coatings that provide durable performance without fading or aging in high output luminaires.



The SWIR range extends from 1.1 – 3.0 μm (1100-3000nm), beyond human vision and primarily in the responsivity of indium gallium arsenide (InGaAs) and mercury cadmium telluride (HgCdTe or MCT) detectors. Many applications involving low light, obscured vision, human tissue, vegetation, water absorption, and other materials have valuable spectral signatures in the SWIR region that can be evaluated using precisely positioned bandpass filters.

LONG EXPOSURE CMOS CAMERAS

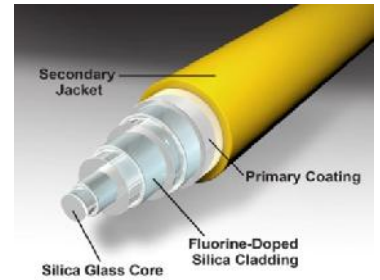
Teledyne Photometrics (Tucson, AZ) announced the release of the Retiga E7—a long exposure optimized CMOS camera boasting low read noise and superior dark current control. The Retiga E7 is a 7 Megapixel CMOS camera with low read noise (2.2 electrons) and ultra-low dark current (0.02 electrons per second) that is comfortably able to detect weak signals while integrating over several minutes. The



Retiga E7 is the next generation of long exposure camera, following the highly successful CCD-based Retiga R-series.

MULTI-CORE OPTICAL FIBERS

Armadillo SIA (Riga, Latvia) recently introduced Multi-Core Optical Fiber: Silica/Silica Concentric Core Fibers for laser power delivery applications. Silica/Silica Concentric Core Fibers feature multi kW power tolerance, non-circular core shape options, power density control, increased precision, a step-index profile, and special jackets that operate in high temperatures, high vacuum and harsh chemical environments. Jacketing options and temperature ranges for primary coatings are: hard clad/fluorinated acrylate (-40 to +80 °C), silicone (-40 to +150 °C), polyimide (-190 to +350 °C), acrylate (-40 to +85 °C), aluminum (-196 to +400 °C). A wide variety of secondary jackets are also available and include PFA Fluon® which operates between -200 and + 260 °C temperature range.



ADVANTAGES

- 1) Immunity from electromagnetic interference (EMI)
- 2) Freedom from electrical short circuits or ground loops
- 3) Safety in combustible environment
- 4) Security from monitoring
- 5) Low-loss transmission
- 6) Large bandwidth (i.e. multiplexing capability)

5G TECHNOLOGY

Name- BITTU KUMAR, 2ND Year, DETCE



In telecommunications, 5G is the fifth-generation technology standard for broadband cellular networks, which cellular phone companies began deploying worldwide in 2019, and is the planned successor to the 4G networks which provide connectivity to most current cellphones. 5G networks are predicted to have more than 1.7 billion subscribers worldwide by 2025, according to the GSM Association.

5G has higher bandwidth and can thus connect more different devices, improving the quality of Internet services in crowded areas.

APPLICATION AREAS

The three main application areas for the enhanced capabilities of 5G –

- Enhanced Mobile Broadband (eMBB),
- Ultra Reliable Low Latency Communications (URLLC),
- Massive Machine Type Communications (mMTC).

Enhanced Mobile Broadband (eMBB) uses 5G as a progression from 4G LTE mobile broadband services, with faster connections, higher throughput, and more capacity. This will benefit areas of higher traffic such as stadiums, cities, and concert venues.

Ultra-Reliable Low-Latency Communications (URLLC) refer to using the network for mission critical applications that require uninterrupted and robust data exchange. The short-packet data transmission is used to meet both reliability and latency requirements of the wireless communication networks.

Massive Machine-Type Communications (mMTC) would be used to connect to a large number of devices. 5G technology will connect some of the 50 billion connected IoT devices.[10] Most will use the less expensive Wi-Fi. Drones, transmitting via 4G or 5G, will aid in disaster recovery efforts, providing real-time data for emergency responders.

PERFORMANCE

- **SPEED**

5G speeds will range from ~50 Mbit/s to over 1,000 Mbit/s (1 Gbit/s). The fastest 5G speeds would be in the mmWave bands and can reach 4 Gbit/s with carrier aggregation and MIMO. Sub-6 GHz 5G (mid-band 5G), by far the most common, will usually deliver between 100 and 1,400 MBit/s but will have a much further reach than mmWave, especially outdoors.

- **LATENCY**

In 5G, the "air latency" is of the order of 8–12 milliseconds. The latency to the server must be added to the "air latency" for most comparisons. Verizon reported the latency on its 5G early deployment is 30 ms: Edge Servers close to the towers can reduce latency to 10–20 ms; 1–4 ms will be extremely rare for years outside the lab. The latency is much higher during handovers; ranging from 50–500 milliseconds depending on the type of handover. Reducing handover latency is an ongoing area of research and development.

- **ERROR RATE**

5G uses adaptive modulation and coding scheme (MCS) to keep the bit error rate extremely low. Whenever the error rate crosses a (very low) threshold the transmitter will switch to a lower MCS, which will be less error-prone. This way speed is sacrificed to ensure an almost zero error rate.

- **RANGE**

The range of 5G depends on many factors; frequency is the most important of all. mmWave signals tend to have a range of only a couple of hundred meters whilst low band signals generally have a range of a couple of kilometers.

Since there is a lot of marketing hype on what 5G can offer, simulators and drive tests are used for the precise measurement of 5G performance.

5G NR (NEW RADIO)

5G NR (New Radio) is a new air interface developed for the 5G network.[27] It is supposed to be the global standard for the air interface of 3GPP 5G networks.

TECHNOLOGY

- New radio frequencies

The air interface defined by 3GPP for 5G is known as New Radio (NR), and the specification is subdivided into two frequency bands, FR1 (below 6 GHz) and FR2 (24–54 GHz).

- Frequency range 1 (< 6GHz)

Otherwise known as sub-6, the maximum channel bandwidth defined for FR1 is 100 MHz, due to the scarcity of continuous spectrum in this crowded frequency range. The band most widely being used for 5G in this range is 3.3–4.2 GHz. The Korean carriers use the n78 band at 3.5 GHz.

- Frequency range 2 (24-54 GHz)

The minimum channel bandwidth defined for FR2 is 50 MHz and the maximum is 400 MHz, with two-channel aggregation supported in 3GPP Release 15. The higher the frequency, the greater the ability to support high data-transfer speeds. Signals in this frequency have been described as mmWave

- FR2 Coverage

5G in the 24 GHz range or above use higher frequencies than 4G, and as a result, some 5G signals are not capable of traveling large distances (over a few hundred meters), unlike 4G or lower frequency 5G signals (sub 6 GHz). This requires placing 5G base stations every few hundred meters in order to use higher frequency bands. Also, these higher frequency 5G signals cannot penetrate solid objects easily, such as cars, trees, and walls, because of the nature of these higher frequency electromagnetic waves.

- Massive MIMO

MIMO systems use multiple antennas at the transmitter and receiver ends of a wireless communication system. Multiple antennas use the spatial dimension for multiplexing in addition to the time and frequency ones, without changing the bandwidth requirements of the system.

Massive MIMO (multiple-input and multiple-output) antennas increases sector throughput and capacity density using large numbers of antennas. This includes Single User MIMO and Multi-user MIMO (MU-MIMO). Each antenna is individually-controlled and may embed radio transceiver components.

- Edge computing

Edge computing is delivered by computing servers closer to the ultimate user. It reduces latency and data traffic congestion

- Small cell

Small cells are low-powered cellular radio access nodes that operate in licensed and unlicensed spectrum that have a range of 10 meters to a few kilometers. Small cells are critical to 5G networks, as 5G's radio waves can't travel long distances, because of 5G's higher frequencies.

Misinformation and controversy

- HEALTH

There is a long history of fear and anxiety surrounding wireless signals that predates 5G technology. The fears about 5G are similar to those that have persisted throughout the 1990s and 2000s. They center on fringe claims that non-ionising radiation poses dangers to human health.[124] Unlike ionising radiation, non-ionizing radiation cannot remove electrons from atoms. The CDC says "Exposure to intense, direct amounts of non-ionizing radiation may result in damage to tissue due to heat. This is not common and mainly of concern in the workplace for those who work on large sources of non-ionizing radiation devices and instruments. Some advocates of fringe health claim the regulatory standards are too low and influenced by lobbying groups. wireless technologies caused numerous conditions from ADHD to heart diseases and brain cancer.

- COVID-19 conspiracy theories and arson attacks

The World Health Organization published a mythbuster infographic to combat the conspiracy theories about COVID-19 and 5G.

As the introduction of 5G technology coincided with the time of COVID-19 pandemic, several conspiracy theories circulating online posited a link between SARS CoV2 and 5G. This has led to dozens of arson attacks being made on telecom masts in the Netherlands (Amsterdam, Rotterdam, etc.), Ireland (Cork, etc.), Cyprus, the United Kingdom (Dagenham, Huddersfield, Birmingham, Belfast and Liverpool, Belgium (Pelt), Italy (Maddaloni), Croatia (Bibinje) and Sweden. It led to at least 61 suspected arson attacks against telephone masts in the United Kingdom alone and over twenty in The Netherlands.

ADVANTAGES

Download speed

Hyperconnectivity

Higher Process optimization

Decrease in latency

DIS-ADVANTAGES

Immediate obsolescence

Technological exclusion

Insufficient Infrastructure

Risks in security and proper data

ROBOTIC PROCESS AUTOMATION (RPA)

NAME-Supriyo Chatterjee, 2ND YEAR, DETCE

Introduction

Robotic process automation (RPA) is a software technology that makes it easy to build, deploy, and manage software robots that emulate humans actions interacting with digital systems and software. Just like people, software robots can do things like understand what's on a screen, complete the right keystrokes, navigate systems, identify and extract data, and perform a wide range of defined actions. But software robots can do it faster and more consistently than people, without the need to get up and stretch or take a coffee break.

Why is RPA transformative?

RPA technology is changing how the world gets work done.

Software robots—instead of people—do repetitive and lower-value work, like logging into applications and systems, moving files and folders, extracting, copying, and inserting data, filling in forms, and completing routine analyses and reports. Advanced robots can even perform cognitive processes, like interpreting text, engaging in chats and conversations, understanding unstructured data, and applying advanced machine learning models to make complex decisions.

When robots do these types of repetitive, high-volume tasks, humans are freed to focus on the things they do best and enjoy more: innovating, collaborating, creating, and interacting with customers. Enterprises get a boost too: higher productivity, efficiency, and resilience. It's no wonder that RPA is rewriting the story of work.

Use of RPA

Today, RPA is driving new efficiencies and freeing people from repetitive tedium across a broad swath of industries and processes. Enterprises in industries ranging from financial services to healthcare to manufacturing to the public sector to retail and far beyond have implemented RPA in areas as diverse as finance, compliance, legal, customer service, operations, and IT. And that's just for starters.

RPA has become so widespread because it is broadly applicable. Virtually any high-volume, business-rules-driven, repeatable process is a great candidate for automation—and increasingly so are cognitive processes that require higher-order AI skills.



Important features and capabilities in RPA technology

To build and manage an enterprise-wide RPA program, you need technology that can go far beyond simply helping you automate a single process. You require a platform that can help you create and manage a new enterprise-wide capability and help you become a fully automated enterprise™. Your RPA technology must support you end-to-end, from discovering great automation opportunities everywhere, to quickly building high-performing robots, to managing thousands of automated workflows.

Why is RPA the fastest-growing enterprise software in the world?

When you combine RPA's quantifiable value with its ease of implementation relative to other enterprise technology, it's easy to see why RPA adoption has been accelerating worldwide.

RPA can help many different types of industries address their specific operational issues in new and powerful ways.

Leaders of functional areas from finance to customer service to marketing to human resources and beyond find that RPA improves many processes, yielding higher capacity, faster throughput, and fewer errors for key processes. From a CFO's perspective, an investment in RPA technology delivers rapid ROI and requires minimal upfront spending compared to other enterprise technology.

IT executives find that RPA can be implemented with little disruption. And because software robots can easily access and work within legacy systems, RPA has become a key enabler for digital transformation. And modern RPA technology offers scalable, enterprise-ready platforms.

Employees find that it's easy to adopt robotic assistants into their workdays, and that RPA's low-code approach lets them become citizen developers who can build their own simple automations.

Is RPA the same as artificial intelligence (AI)?

RPA is not AI; AI is not RPA. But the combination of RPA and AI unlocks massive new possibilities for enterprises everywhere. For one thing, RPA technology now makes it possible to insert advanced AI skills in the form of machine learning models, natural language processing (NLP), character and image recognition, and more into RPA robots. Giving robots these AI skills dramatically expands their ability to handle cognitive processes that require things like:

Understanding documents including semi-structured or unstructured data

Visualizing screens (including virtual desktops)

Comprehending speech and carrying on conversations and chats

AI is also making it possible to scientifically discover a complete range of automation opportunities and build a robust automation pipeline through RPA applications like process mining.

And at a time when companies need to accelerate their integration of AI into front-line activities and decisions, many are finding that RPA can serve as AI's 'last-mile' delivery system. Robots can be configured to apply machine learning models to automated decision-making processes and analyses, bringing machine intelligence deep into day-to-day operations.

