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Advancements in Wireless Communication

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Abstract

A lot of people in the world depend on wireless powered devices for communication and information sharing. Wireless communication technology is evolving expeditiously to meet the requirements of the users. With the exponential rise in wireless devices, many challenges have been exposed in wireless networking and their integration with the future internet. This has led many researchers to develop novel and effective wireless transmission technologies and applications to support a large amount of wireless communication with improved quality of services, higher data transmission rate, and lower delay. In recent years, several encouraging wireless technologies have been proposed to enhance wireless communications quality. Industry experts need to have proper circulation of information among each other on these new advancements for rapid adaptability and more advanced researches.

Keywords — *Communication, Wireless, Networking, Technologies.*

I. INTRODUCTION

Humans have always dreamed of possessing the potential to communicate with each other anytime, anywhere. Kings, nation-states, military forces, and business cartels have looked for more and better ways to acquire timely information of strategic or economic values from across the globe. Travelers have often been willing to pay premiums to communicate with family and friends back home.

Wireless communication is one of the fastest-growing fields of the dynamic communication industry. Cellular phones have shown substantial exponential growth, which has reached about one billion mobile phone users worldwide [1]. Certainly, mobile phones have become one of the most important ingredients of our daily life and a critical business tool worldwide. Wireless communication means communication over the radio, though ultrasound and infrared light are also used occasionally. The term "wireless" means nonbroadcast communication, usually between individuals who often use portable or mobile equipment. Before we move into the advancements, we will cover the history of Wireless Communication.

II. HISTORY OF WIRELESS COMMUNICATION

Most of this paper deals with the current scenario of wireless communication, with some speculation as to the future. However, to understand the present state, a brief glimpse of the past will be beneficial. Present-day systems have advanced from their precursors, some of which are still intact with us.

Similarly, we can expect that future systems will evolve from the current ones. The inception of Wireless Communication can be traced back to the 1880s. Morse's telegraphy in 1837 and Bell's the telephone invented in 1876 were soon followed by Hertz's first experiments with a radio (1887). Hertz's system was just a laboratory curiosity, but Marconi was the one who communicated across the English Channel in 1899 and across the Atlantic Ocean in 1901. A brief letter sent between Britain and Canada was the first wireless message. These successes led to the radio's widespread use for a ship to shore communication using Morse code [2].

Early wireless systems were utilizing crude, often powerful, spark-gap transmitters and were suitable only for radiotelegraphy. The discovery of the triode vacuum tube by De Forest in 1906 allowed the modulation of a continuous wave signal and made voice transmission practical. There is a dispute about exactly who did what first but, it appears likely that Reginald Fessenden made the first public broadcast of voice and music in late 1906.

Early radio transmitters were too unwieldy to be installed in vehicles. The first mobile radio systems for police departments only had a receiver in the police car. The first system to be considered practical was installed in Detroit in 1928. It was the mid-1930s when two-way police radio with the equipment occupying most of the car trunk began. Amplitude modulation (AM) was used until the late 1930s, when frequency modulation (FM) began to replace it.

World War II provided a significant push for the development of mobile and portable radio systems, including two – way systems known as "walkie talkies" that could be carried in the field and

are considered as the distant ancestors of today's cell phones. FM proved its benefits over AM in the war. History has helped a lot in shaping today's communication system.

III. ELEMENTS OF A WIRELESS COMMUNICATION SYSTEM

The most basic wireless system consists of a transmitter, receiver, and a channel, usually a radio link, as shown in fig. 1. Since we cannot use the radio directly with low frequency, it is necessary to superimpose the information content onto a higher frequency carrier signal at the transmitter, using modulation. Modulation also allows the radio channel to be utilized by more than one signal by using a different carrier frequency for each. Demodulation is the inverse modulation process performed at the receiver to recover the original information [3].

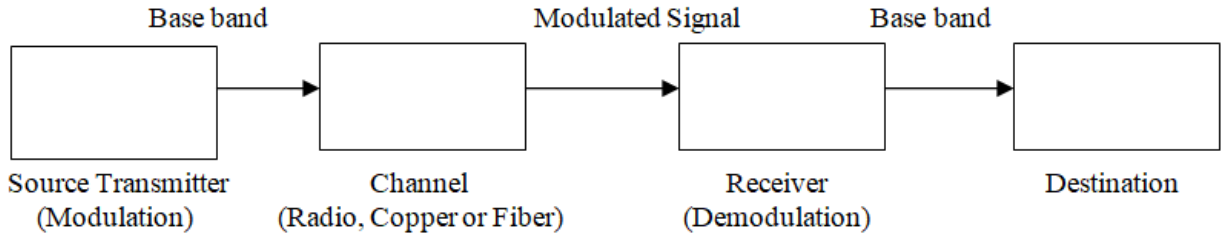

Fig 1: Signal Modulation

IV. TECHNOLOGY ADVANCEMENT

A. *Radio*

The early research of mobile radio was motivated by public safety needs. Detroit was the first city to experiment with radio-dispatched police cars in 1921. However, transmission from vehicles was limited due to the difficulty of producing small, low-power transmitters suitable for automobiles. Two-way systems were first used in Bayonne, New Jersey, in the 1930s.

Due to no small Wi-Fi growth, a new electronic wizardry concept is found in our homes and offices. Stephen Lawson sees one of the recent technological advancements in Wi-Fi hotspots and cellular radios. Fast-growing mobile data use drives demand for equipment that can cover indoor spaces and serve crowded public places. Wi-Fi access points, specially designed for public hotspots, offload traffic from cellular infrastructure, and small cells allow carriers to reuse their licensed frequencies for greater capacity [4].

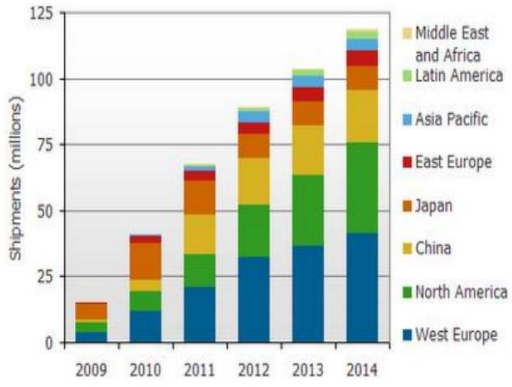

Fig 2: Advancement in radio technology in different areas

B. *Mobile*

One of the technological advancements is seen in current cancer research plans by UK-CMRL to give access to new reagents, infrastructure, and data technologies required to make the fastest development in cancer research to work with MRC, UCL. Another advancement in mobile mapping technology is developed in these years in which penetration of internet mapping, personal navigation, and satellite imaging have opened up great research and business opportunities to geospatial communities by which sensors can be mounted on various platforms such as satellite, aircraft, or helicopters, terrestrial vehicles, water-based vehicles, etc. [5].

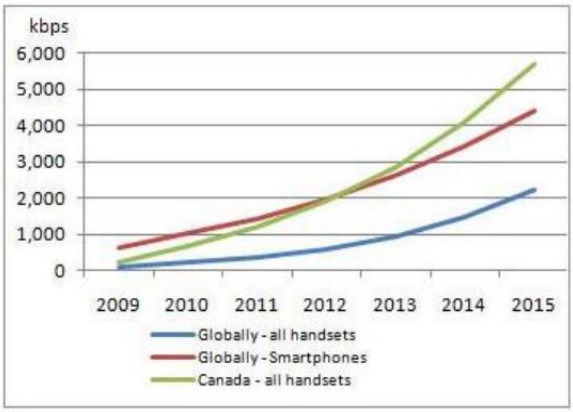

Fig 3: Technology advancement in mobile in 2009-2014

C. *Internet*

The original fundamentals underlying the internet were developed in the mid-1960s at the Defense Advanced Research Projects Agency (DARPA), then ARPA. The original application was the ARPANET, established in 1969 to provide computer communications networks. The ARPANET depended heavily on packet switching theories

developed in the 1960s at the Massachusetts Institute of Technology and Great Britain's National Physical Laboratory. This approach proved to be a departure from the circuit-switching systems used in telephone networks [6].

This field has impacted our whole world of Science and Engineering. In recent technology advancement, we have achieved our top goals, increased bandwidth, e-commerce, online video, and online shopping, search engines like Google and yahoo, social network sites, blogs, smartphones, online collaboration, and webinars, etc. As it has become an era of the internet, new research is being done in this technology, which gives product enhancements to IoT devices that include smart devices with higher computation and more incredible speed that will help drive market growth.

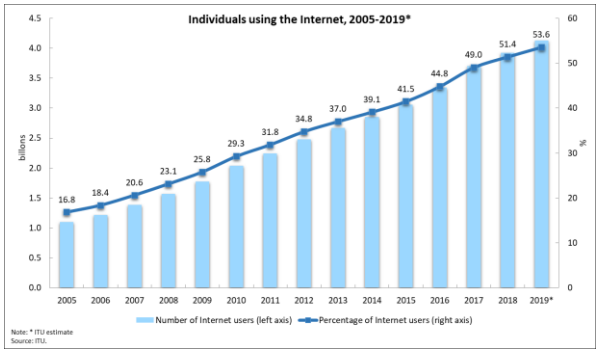

Fig 4: Growth of internet users over the years

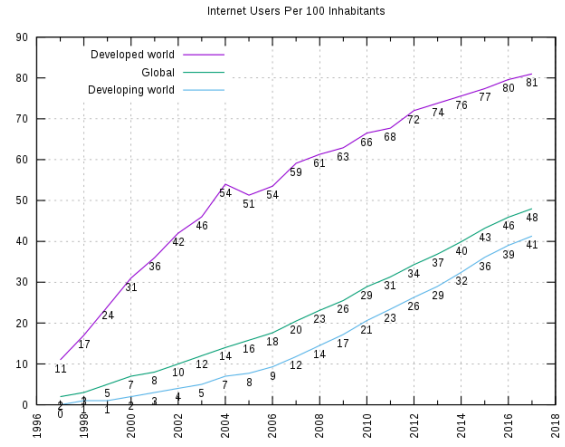

Fig 5: Global internet usage

D. RFID

Radio-frequency identification (RFID) tags and tag readers make use of proximity, and they have an automated ad hoc setup for transferring a small amount of information. The RFID tags' main features are a unique identifier and proximity of RFID tags to a tag reader. However, there are some kinds of RFID tags that have a predefined list of identifiers. Some manufacturers have also built RFID tags compatible with Wi-Fi networks to extend location tracking to the whole Wi-Fi network, avoiding the need for an extra tracking network. The cheapest kind of RFID tags is passive because they draw their power to transmit from the tag reader's radio signal. They are commonly utilized to track objects' movement, typically at distances of up to a few meters, but potentially up to 200 meters with 'active' or 'semi-active' tags. RFID tags are also used to control and monitor automatic gate entry systems and tag animals and, occasionally, people. Their usage is being increased in asset tracking and security applications. Adding a unique identifier to objects that can be tracked is beneficial and should lead to further innovations, especially in combination with other technologies [7].

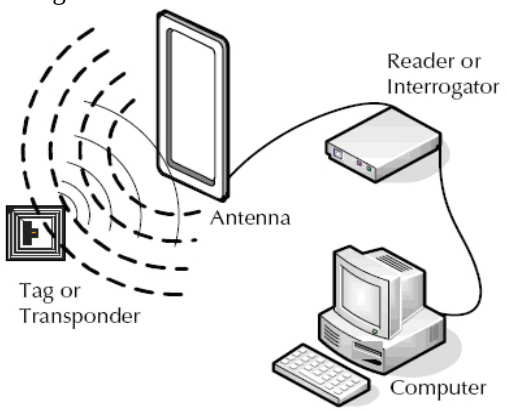

Fig 6: Basic RFID system

E. NFC

Like RFID tags and readers, near field communication (NFC) is also a short-range wireless technology for transmitting a small amount of information. However, NFC operates at a relatively lesser range of up to 20 centimeters. It differs from other wireless communication networks like Wi-Fi because it uses proximity and an automated Adhoc communication setup. NFC is about to see widespread usage in the UK in contactless payment systems, with many new digital wallet companies keen to share that market. A highlighting feature of NFC technology is its very low power requirement. The key benefit of NFC is the universal simplicity of intentionally making things proximate to initiate some action. It will become a pioneer for many services [8].

F. Bluetooth

There are several Bluetooth versions with different characteristics, but it is intended to transfer a considerable amount of information up to 100 meters. The latest version 4 of Bluetooth specifies three protocols: Classic Bluetooth - the standard Bluetooth protocol, Bluetooth high speed - based on Wi-Fi, and Bluetooth Smart, a.k.a. Bluetooth low energy – known for low power consumption and fast connection setup. The Beam feature of the Android operating system pairs NFC with Bluetooth to yield short-range point-to-point information transfer, thereby increasing the likelihood of utilizing more Bluetooth shortly. Bluetooth beacons can set up Bluetooth-enabled devices, providing new uses for

Bluetooth in indoor real-time positioning systems. The new low power version of Bluetooth (Bluetooth Smart) means that it is left running for a lot of time and becomes useful for location services using Bluetooth. Real-time location services are already very important, so establishing and tracking indoor locations where GPS does not work well could easily become extremely important for Bluetooth. However, other technologies with different characteristics (e.g., Wi-Fi, DASH7, ZigBee) are said to be strong competitors for real-time location services, especially when embedded in personal devices like smartphones and tablets.

V. THE FUTURE

A. 5G

Many in the telecommunications industry are continuing to upgrade wireless communication. Even though many countries are still undergoing 4G, Intel already provided 5G at the 2018 Olympic Winter Games.

5G cellular systems have started to be deployed. The complete rollout will take around five to eight years. In some cases, the technology may overcome Wi-Fi, as it is more cost-effective for high-speed data networking in large sites, such as ports, airports, and factories. With an enhanced wireless network, however, companies like AT&T, Verizon, and Sprint are hoping to support the Internet of Things (IoT), which is expanding outside of the business world and coming into the daily lives of consumers, who are now adopting smart devices, self-driving, and connected cars, and drones [9].

B. Li-Fi

Companies are also working on upgrading Wi-Fi networks. Li-Fi is a technology that plans to deliver a faster connection and a more secure one. Li-Fi operates through LED bulbs, which connect to a computer or laptop via a dongle.

Li-Fi delivered a consistent speed of 1 gigabyte per second (Gbps). However, in labs, it has reached up to 224 Gpbs, which is fast enough to download more than a dozen high-quality movies in a single second. This may look like a possible real-world speed for future wireless networks, but it's unlikely for the near future [10].

VI. CONCLUSION

This paper's main focus was on the impact of technologies in wireless technology operating in various areas. The use of wireless communication technologies, including cellular radio, mobile phones, IoT devices, wireless modems, Wi-Fi, local area networks (LANs), plus multipoint distribution systems (LMDS) for wireless delivery of television internet service, is exploding rapidly. Wireless Communication Technology provides the basic and essential electronics information users need. The telecommunications industry has evolved a lot in the past decades. Its predicted growth is more than one trillion networked devices in use by 2025.

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