LECTURE NOTE 2 [CSC 421]

MOBILE AND WIRELESS COMPUTING

2.1 Mobile and Wireless Computing

Mobile and wireless Computing is a technology that allows the transmission of data, voice, and video via a computer or any other wireless-enabled device without having to be connected to a fixed physical link. Computing Technologies are the technologies that are used to manage, process, and communicate data. Wireless simply means without any wire i.e., connecting with other devices without any physical connection.

Wireless computing is transferring data or information between computers or devices that are not physically connected and have a "*wireless network connection*". For example, mobile devices, Wi-Fi, wireless printers and scanners, etc. Mobiles are not physically connected but they too can transfer data. Mobile computing allows transferring of the data/information, audio, video, or any other document without any connection to the base or central network.

Below are some wireless/mobile computing technologies:

1. **Global System for Mobile Communications (GSM):**
   GSM is a current circuit-switched wireless data communication technology. It was established in Europe by ETSI (European Telecommunications Standards Institute) in the mid-1980s. GSM network has four (4) different parts whose functions are different: *Mobile Station*, BSS (*Base Station Subsystem*), NSS (*Network Switching Subsystem*), and OSS (*Operation and Support Subsystem*).
   As the name suggests, GSM is widely used for mobile communication. It operates in the frequency band 900-MHz, 1800-MHz, and 1900-MHz. GSM was developed using TDMA (Time Division Multiple Access) for better communication using mobile.
   It is the most widely used mobile communication system and is mostly required nowadays. It can achieve a maximum data transmission speed or data transmission rate of up to 9.6Kbps (Kilobits per second).

2. **Code-Division Multiple Access (CDMA):**
   CDMA is a type of wireless computing technology. It is developed during World War II. This technology is mostly used as it provides better network quality, more storage capacity for voice and data communications than TDMA, decreases system noise and interference using power control, and provides more security by encoding the user transmission data into a unique code.
   CDMA does not provide any user with a specific frequency instead utilizes the entire frequency spectrum available for transmission. It operates in the frequency range of 800 MHz to 1.9 GHz. It uses Soft Handoff that reduces signal breaks.

3. **Wireless in Local Loop (WLL):**

   WLL is a widely used technology for wireless communication. It is also called a *Fixed Wireless Loop*. WLL is very easy to develop and less time is required to install, very cost-

effective as wireless systems are less expensive because the cost of cable installation is not added.

WLL allows users to connect to the local telephone station using a wireless link and provides advanced features of customer service. It provides high-quality data transmission and a high data rate. Generally, two types of WLL techniques are available: Local Multipoint Distribution Service (LMDS) and Multichannel Multipoint Distribution Service (MMDS).

4. **General Packet Radio Service (GPRS):**

GPRS is a type of Packet-based Wireless communication technology. It was established by ETSI (European Telecommunications Standards Institute). GPRS can achieve a data transfer rate of up to 114Kbps. It is very cost-effective, highly stable, and can achieve a maximum data rate of up to 114Kbps (Kilobits per second).

It supports Internet Protocol (IP), X.25 (standard protocol for packet-switched data communication), and Point-to-Point Protocol (PPP), and is based on Gaussian minimum-shift keying (GMSK) which is a modulation technique.

The Gateway GPRS Service Node (GGSN) and the Serving GPRS Service Node (SGSN) are the two core modules required to enable GPRS on a GSM network or TDMA network.

5. **Short Message Service (SMS):**

SMS was initially created for phones/mobiles that use GSM for Mobile communication. This service is used to send text messages even without an Internet connection between two or more mobile devices. This technique is very easy, user-friendly, comfortable, and the most effective means of wireless communication.

In this service, less time is required for communication. It does not require any Internet connection for sending text messages. It allows the transmission of short messages i.e., up to 160 characters in length. SMS uses standardized communication protocols. SMS is received by a Short Message Service Center (SMSC).

2.2 Mobile communication

Mobile communication refers to the infrastructure put in place to ensure that seamless and reliable communication goes on. These would include devices such as protocols, services, bandwidth, and portals necessary to facilitate and support the stated services.

The data format is also defined at this stage, this ensures that there is no collision with other existing systems which offer the same service. The media is unguided/unbounded, the overlaying infrastructure is radio wave-oriented.

That is, the signals are carried over the air to intended devices that are capable of receiving and sending similar kinds of signals.

2.3 Mobile Hardware

Mobile devices or device components that receive or access the service of mobility. They could range from Laptops, Smartphones, Tablets, PCs, and Personal Digital Assistants.

2.4 Mobile Software

Mobile software is the actual program that runs on the mobile hardware. It deals with the characteristics and requirements of mobile applications. This is the engine of the mobile device and the operating system of the appliance. It's the essential component that operates the mobile device. Since portability is the main factor, this type of computing ensures that users are not tied or pinned to a single physical location, but can operate from anywhere. It incorporates all aspects of wireless communications.

2.5 Mobile Classification

Mobile computing is not only limited to mobile phones, there are various gadgets available in the market that are built on a platform to support mobile computing.

They are usually classified into the following categories:

2.5.1 Personal Digital Assistant (PDA):

The main purpose of this device is to act as an electronic organizer or day planner that is portable, easy to use, and capable of sharing information with your computer systems. PDA is an extension of the PC, not a replacement. These systems are capable of sharing information with a computer system through a process or service known as synchronization.

Both devices will access each other to check for changes or updates in the individual devices. The use of infrared and Bluetooth connections enables these devices to always be synchronized.

With PDA devices, a user can browse the internet, listen to audio clips, watch video clips, edit and modify office documents, and many more services. The device has a stylus and a touch-sensitive screen for input and output purposes.

2.5.2 Smartphones:

It combines the features of a PDA with that of a mobile phone or camera phone. It has a superior edge over other kinds of mobile phones. Smartphones can run multiple programs concurrently. These phones include high-resolution touch screens, and web browsers that can access and properly display standard web pages rather than just mobile-optimized sites.

They get high-speed data access via Wi-Fi and high-speed cellular broadband. The most common mobile Operating Systems (OS) used by modern smartphones include:

Google's Android, Apple's iOS, Nokia's Symbian, Samsung's Bada and Microsoft's Windows Phone, RIM's BlackBerry OS, and embedded Linux distributions such as Maemo and MeeGo.

Such operating systems can be installed on different phone models, and typically each device can receive multiple OS software updates over its lifetime.

2.5.3 **Tablet PC and iPads:**

This mobile device is larger than a mobile phone or a PDA integrated into a touch screen and is operated using touch-sensitive motions on the screen. They are often controlled by a pen or by the touch of a finger.

They are usually in slate form and are light in weight. Examples would include iPads, Galaxy Tabs, Blackberry Playbooks, etc. They offer the same functionality as portable computers. They support mobile computing in a far superior way and have enormous processing horsepower.

Users can edit and modify document files, access high-speed internet, stream video, and audio data, receive and send e-mails, and attend/give lectures and presentations among its very many other functions. They have excellent screen resolution and clarity.

2.6 Advantages of Mobile Computing

❖ *Location Flexibility*: This has enabled users to work from anywhere as long as there is a network connection established.

❖ *Saves Time*: The time consumed or wasted while traveling from different locations or to the office and back, has been slashed.

❖ *Enhanced Productivity*: Users can work efficiently and effectively from whichever location they find comfortable.

❖ *Ease of Research*: It has made it easier for field officers and researchers to collect data from wherever they are without making unnecessary trips.

❖ *Entertainment*: It's easy to access a wide variety of movies and informative material.

❖ *Streamlining of Business Processes*: Business processes are now easily available through secured connections.

2.7 Security Issues

- Due to its nomadic nature, it's not easy to monitor the proper usage.
- Users might have different intentions on how to utilize this privilege.
- Improper and unethical practices such as hacking, industrial espionage, pirating, online fraud, and malicious destruction are a few of the problems experienced in mobile computing.
- Another problem plaguing mobile computing is credential verification.
- Identity theft is very difficult to contain or eradicate.

Necessary precautions to minimize these threats are:

- ➢ Hiring qualified personnel.
- ➢ Installing security hardware and software.
- ➢ Educating the users on proper mobile computing ethics.
- ➢ Enforcing proper access rights and permissions.

2.8 Current Trends

These are the list of the current mobile technologies starting from 5G technologies which is the hottest mobile technology available in the market.

2.8.1 **5G:**

5G is the fifth-generation technology standard for broadband cellular networks. Telecom companies began to deploy it in 2019 and is the successor to the 4G networks providing connectivity to most current cell phones.

5G networks' service area is divided into small geographical areas called *cells*. All 5G wireless devices in a cell are connected to the Internet and telephone network by radio waves through a local antenna in the cell.

It has the advantage of having greater bandwidth and download speed up to 10 gigabits per second (Gbit/s). 5G is not only faster than existing networks, 5G can connect more different devices.

Due to the increased bandwidth, the networks will increasingly be used as general internet service providers (ISPs) for laptops and desktop computers and also will make possible new applications in internet-of-things (IoT) and machine-to-machine areas.

2.8.2 **4G:**

4G is the fourth generation of broadband cellular network technology that precedes 5G. Recent application areas include mobile web access, IP telephony, gaming services, high-definition mobile TV, video conferencing, and 3D television.

- WiMAX: (Worldwide Interoperability for Microwave Access) is a wireless communications standard designed to provide 30 to 40 megabit-per-second data

rates, with the latest update providing up to 1 Gbit/s for fixed stations. It is part of the fourth generation or 4G wireless communication technology.

- Long-Term Evolution (LTE): LTE is a standard for wireless communication of high-speed data for mobile phones and data terminals. It is considered as 4G LTE. It is based on the GSM/EDGE and UMTS/HSPA network technologies, increasing the capacity and speed using new modulation techniques

2.8.3 3G:

3G mobile telecommunications is a generation of standards for mobile phones and mobile telecommunication services fulfilling the International Mobile Telecommunications-2000 (IMT-2000) specifications by the International Telecommunication Union.

Application services include wide-area wireless voice telephone, mobile Internet access, video calls, and mobile TV, all in a mobile environment.

2.8.4 Global Positioning System (GPS):

The Global Positioning System (GPS) is a space-based satellite navigation system that provides location and time information in all weather, anywhere on or near the Earth, where there is an unobstructed line of sight to four or more GPS satellites.

The GPS program empowers military, civil, and commercial users around the world.

It is the backbone for modernizing the global air traffic system, weather, and location services.

2.8.5 Near Field Communication:

Near Field Communication (NFC) is a set of standards for smartphones and similar devices to establish radio communication with each other by touching them together or bringing them into proximity, usually no more than a few centimeters.

Present and anticipated applications include contactless transactions, data exchange, and simplified setup of more complex communications such as Wi-Fi. Communication is also possible between an NFC device and an unpowered NFC chip, called a "tag".