Advanced Mobile Computing and Networking - CS 560

Assessment
- CA 40%
- Assignment 20%
- 2 Tests 10% each
- Exam 60%

Wireless Technologies

- Bluetooth, Infrared Data Association (IrDA), HomeRF, and Institute of Electrical and Electronic Engineers (IEEE) 802.11 standards.
- Advantages and Disadvantages of each
- Regulatory and standards bodies

Bluetooth

- Bluetooth is a high-speed, low-power, microwave wireless link technology
- designed to connect phones, laptops, personal digital assistants (PDAs), and other portable Equipment
- with little or no work by the user.
- Unlike infrared, Bluetooth does not require line-of-sight positioning of connected units.

Bluetooth

- The technology uses modifications of existing wireless LAN techniques
- but is most notable for its small size and low cost.
- Whenever any Bluetooth-enabled devices come within range of each other,
- they instantly transfer address information and establish small networks between each other, without the user being involved.

Bluetooth

- Features of Bluetooth technology are as follows:
  - Operates in the 2.56 gigahertz (GHz) ISM band, which is globally available
  - (no license required)
  - Uses Frequency Hop Spread Spectrum (FHSS)
  - Can support up to eight devices in a small network known as a "piconet"
  - Omnidirectional, nonline-of-sight transmission through walls
  - 10 m to 100 m range

Bluetooth

- Low cost
- 1 mw power
- Extended range with external power amplifier (100 meters)

IrDA

- IrDA is an international organization that creates and promotes interoperable, low-cost, infrared data interconnection standards.
- IrDA has a set of protocols covering all layers of data transfer and, in addition, has some network management and interoperability designs.
- IrDA protocols have IrDA DATA as the vehicle for data delivery and IrDA CONTROL for sending the control information.

IrDA

- In general, IrDA is used to provide wireless connectivity technologies for devices that would normally use cables for connectivity.
- IrDA is a point-to-point, narrow-angle (30° cone), ad hoc data transmission standard
- designed to operate over a distance of zero to one meter and at speeds of 9600 bits per second (bps) to 16 Mbps.

IrDA

- Features of IrDA are as follows:
  - Range: From contact to at least one meter, and can be extended to two meters.
  - A low-power version relaxes the range objective for operation from contact through at least 20 centimeters (cm) between low-power devices
  - and 30 cm between low-power and standard-power devices.

IrDA

- This implementation affords ten times less power consumption.
- Bidirectional communication is the basis of all specifications.
- Data transmission from 9600 bps with primary speed or cost steps of 115 kilobitsper second (kbps) and maximum speed of up to 4 Mbps.
- Data packets are protected using a Cyclic Redundancy Check (CRC) (CRC-16 for speeds up to 1.152 Mbps, and CRC-32 at 4 Mbps).

Comparison of Bluetooth and IrDA

- Bluetooth and IrDA are both critical to the marketplace.
- Each technology has advantages and drawbacks, and neither can meet all users' needs.
- Bluetooth's ability to penetrate solid objects
- and its capability for maximum mobility allow for data exchange applications that are very difficult or impossible with IrDA

Comparison of Bluetooth and IrDA

- For example, with Bluetooth, a person could synchronize his or her phone with a personal computer (PC) without taking the phone out of a pocket or purse;
- this is not possible with IrDA.
- The Omni directional capability of Bluetooth allows synchronization to start when the phone is brought into range of the PC.

Comparison of Bluetooth and IrDA

- On the other hand, in applications involving one-to-one data exchange,
- IrDA is at an advantage.
- Consider an application where there are many people sitting across a table in a meeting.
- Electronic cards can be exchanged between any two people by pointing their IrDA devices toward each other (because of the directional nature).

Comparison of Bluetooth and IrDA

- In contrast, because Bluetooth is omnidirectional in nature,
- the Bluetooth device will detect all similar devices in the room and
- the user would have to select the intended person from, say, a list provided by the Bluetooth device.
- On the security front, Bluetooth provides security mechanisms which are not present in IrDA

Comparison of Bluetooth and IrDA

- However, the narrow beam (in the case of IrDA) provides a low level of security.
- IrDA beats Bluetooth on the cost front.
- The Bluetooth standard defines layers 1and 2 of the Open System Interconnection (OSI) model.

Comparison of Bluetooth and IrDA

- The application framework of Bluetooth is aimed to achieve interoperability with IrDA and Wireless Access Protocol (WAP).
- In addition, a host of other applications will be able to use the Bluetooth technology and protocols

HomeRF

- HomeRF is a subset of the International Telecommunication Union (ITU) and
- primarily works on the development of a standard for inexpensive radio frequency (RF) voice and data communication

HomeRF

- The HomeRF Working Group has also developed the Shared Wireless Access Protocol (SWAP).
- SWAP is an industry specification that permits PCs, peripherals, cordless telephones, and other devices to communicate voice and data without the use of cables.

HomeRF

- SWAP is similar to the Carrier Sense Multiple Access with Collision Avoidance (CSMA/CA) protocol of IEEE 802.11
- but with an extension to voice traffic.
- The SWAP system can operate either as an ad hoc network or as an infrastructure network under the control of a connection point.

HomeRF

- In an ad hoc network, all stations are peers,
- and control is distributed between the stations and supports only data.
- In an infrastructure network, a connection point is required so as to coordinate the system,
- and it provides the gateway to the public switched telephone network (PSTN)

HomeRF

- Walls and floors do not cause any problems in its functionality,
- and some security is also provided through the use of unique network IDs.
- It is robust and reliable, and minimizes the impact of radio interference

HomeRF

- Features of HomeRF are as follows:
  - Operates in the 2.45 GHz range of the unlicensed ISM band.
  - Range: up to 150 feet.
  - Employs frequency hopping at 50 hops per second.
  - It supports both a Time Division Multiple Access (TDMA) service to provide delivery of interactive voice and
  - a CSMA/CA service for delivery of high-speed data packets.

HomeRF

- The network is capable of supporting up to 127 nodes.
- Transmission power: 100mW.
- Data rate: 1 Mbps using 2 frequency-shift keying (FSK) modulation and
- 2 Mbps using 4 FSK modulation.
- Voice connections: up to 6 full duplex conversations

Comparison of Bluetooth with (SWAP)

- Currently SWAP has a larger installed base compared to Bluetooth,
- but it is believed that Bluetooth is eventually going to prevail.
- Bluetooth is a technology to connect devices without cables.
- The intended use is to provide short-range connections between mobile devices and to the Internet via bridging devices to different networks (wired and wireless) that provide Internet capability.

Comparison of Bluetooth with (SWAP)

- HomeRF SWAP is a wireless technology optimized for the home environment.
- Its primary use is to provide data networking and
- dial tones between devices such as PCs, cordlessphones, Web tablets, and a broadband cable or Digital Subscriber Line (DSL) modem.

Comparison of Bluetooth with (SWAP)

- Both technologies share the same frequency spectrum
- but do not interfere with each other when operating in the same space.
- As far as comparison with IrDA is concerned, SWAP is closer to Bluetooth in its scope and domain,

802.11 (WiFi)

- When the concept of using radio signals to connect various computers in a building was introduced,
- the IEEE formed a committee called 802.11 committee, to set the standards for the technology
- The committee developed various standards known as 802.11a, or 802.11b, 802.11g, and so forth.
- This group of 802.11 standards became known as WiFi technology

802.11 (WiFi)

- Because WiFi technology quickly became popular,
- the cost of WiFi equipment has decreased rapidly.
- Many organizations and wireless Internet Service Providers (ISPs) have started with WiFi.

802.11 (WiFi)

- WiFi is a common wireless technology used by home owners, small businesses, and starting ISPs.
- WiFi devices are available "off the shelf" from computer stores, and
- enhanced WiFi devices are designed for ISP use.

802.11 (WiFi)

- Advantages of WiFi are as follows:
  - Ubiquitous and vendor neutral; any WiFi device will work with another regardless of the manufacturer.
  - Affordable cost.

802.11 (WiFi)

- Hackable; many "hacks" exist to extend the range and performance of a WiFi network.
- Disadvantages are as follows:
  - Designed for LANs, not wide area networking (WAN).

802.11 (WiFi)

- Uses the CSMA mechanism.
  - Only one wireless station can "talk" at a time, meaning one user can potentially hog all of the network's resources.
- Applications such as video conferencing, Voice-Over Internet Protocol (VOIP), and multimedia can take down a network.

802.16 (WiMax)

- WiMax is a superset of WiFi and is designed specifically for last-mile distribution and mobility.
- WiMax promises high speed (30 Mbps+).
- WiMax is a relatively new standard; thus, WiMax products are expensive.

802.16 (WiMax)

- An advantage of WiMax is as follows:
  - Specifically designed for wide area networking.
- Disadvantages of WiMax are the following:
  - New technology; has not passed the test of time (yet).
  - More expensive than WiFi.

PRESENTATIONS

- An overview of wireless sensor networks
- Routing ; TCP/IP and other protocols. Ad hoc networking protocols, Mobile IP
- Channel allocation: basic strategies, congestion control, static and dynamic routing, concept of channel borrowing

- Mobile computing : database requirements, computing within a building, within a city and outside city
- Proxy servers and applications: wireless Internet, remote data access, global positioning, document tracing, health care, warehouse, automated vending