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Computer Science and Engineering
B.Tech. VIII th Semester

CS442
Wireless Sensor Network

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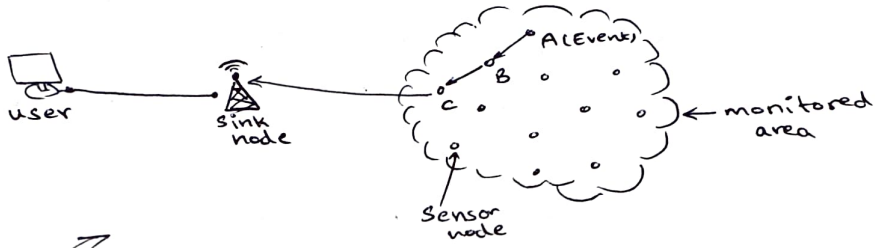
Q.10

(a) Show the interconnections among different components of a WSN node? Draw the architecture of a typical WSN. [2]

→ ~~Interconnections among different components of a WSN node.~~



Architecture of a typical WSN:

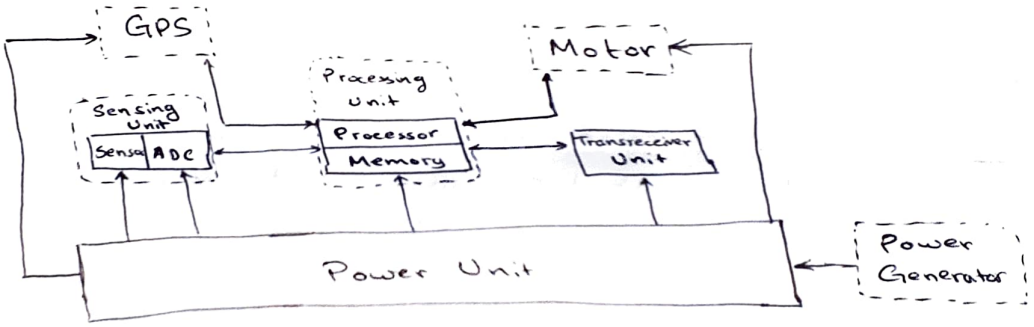


fig.: Interconnections among different components of a WSN Node.

(b) Discuss the challenges of WSN deployment in following aspects: [3]:

(i) Communications:

→
- Finding shortest path from event point to sink.
- Balance the lifetime of all the sensors.

(ii) Target Coverage:

→
- Ensure connectivity.
- Modulating wake-up and sleeping mechanism.
- Covering more targets by the minimum sensors.

(iii) Target Tracking:

→
- Improving tracking accuracy
- Track more than one target at a time
- Long network lifetime.

(c) List the important sensors required for the following applications.

(i) Debris flow monitoring
→ Sensors: Humidity, Temperature, Pressure, Optical

(ii) Habitat Monitoring on Great Duck Island
→ Sensors: Humidity, Temperature, Image, Infrared, Barometric pressure.

(iii) Precision agriculture like wine Making
→ Sensors: Humidity, Temperature

(iv) In LCD plants, to prevent shaking of the glass substrate during processing.
→ Sensors: Seismic, Displacement

(v) interactive LED wall
→ Sensors: Humidity, Temperature, Optical, Ultrasonic

Q.20

(a) Give an expression for free space loss for isotropic antennas with gains at transmitter and receiver. write the empirical path loss formula in Two ray model.

→ Path loss with antenna gains:

$$P_r = P_t \frac{\lambda^2 G_t G_r}{(4\pi d)^2}$$

where,
P_t = Signal power at transmitting antenna
P_r = Signal power at receiving antenna
λ = carrier wavelength
d = Propagation distance between antennas
G_t = Gain at transmitting antenna
G_r = Gain at receiving antenna

Emperical Path loss formula: (Two Ray model)

$$P_r = P_t P_0 \left(\frac{d_0}{d}\right)^{\alpha}$$

where,
α = Pathloss exponent
d_0 = 1m
P_0 = Received power at d_0

1. Define for a signal the following bit time and coherence time, coherence bandwidth, signal bandwidth? [3]

→ Bit time, T_b : Time to propagate 1 bit through the channel.

Coherence Time, T_c : Time duration for which a channel remains same

Coherence Bandwidth, B_c : Bandwidth over which the channel response remains the same.

Signal Bandwidth, B_s : Difference of max and min frequency contain in the signal.

(c) With respect to above, discuss the conditions when following may happen - fast fading, slow fading, flat fading and frequency selective fading? [4]

→ Slow fading : $T_c >> T_b$

Fast fading : $T_b > T_c$

Flat fading : $B_c >> B_s$

Frequency selective fading : $B_s > B_c$

Q. 3.

(a) In FHSS, how the discrete changes of carrier frequency is determined? what are the two versions of FH in FHSS? Which one is more robust, FHSS or DSSS? [1+2+1]

→ Frequency Hopping carrier frequency is determined via pseudo random sequence.

Two versions of FH in FHSS : (i) Fast Hopping
(ii) Slow Hopping

Fast Hopping → Several frequencies per user bit

Slow Hopping → Several user bits per frequency

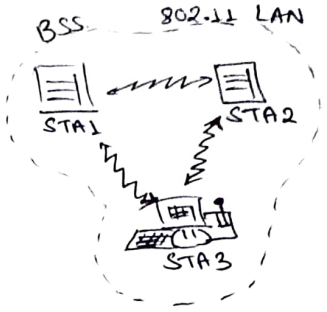
DSSS is more robust than FHSS (textbook-wise). However, FHSS is more Robust than DSSS, as it is able to withstand or overcome adverse conditions, and hence is more suitable to be employed in harsh environments. It is also less susceptible to multipath fading.

(b) Discuss the various components of IEEE 802.11 adhoc and infrastructure network? [6]

→ Components of IEEE 802.11 adhoc (infrastructure less) network:

1. Station (STA)
   It is a terminal with access mechanisms to the wireless medium.

2. Basic Service Set (BSS)
   It is a group of stations using the same radio frequency.



Components of IEEE 802.11 infrastructure network.

1. Station (STA)
   It is a terminal with access mechanisms to the wireless medium and radio contact to the access point.

2. Basic Service Set (BSS)
   It is a group of stations using the same radio frequency.

3. Access Point (AP):
   It is a station integrated into the wireless LAN (WLAN) and the distribution system.

4. Portal:
   It is a bridge to other wired networks.

5. Distribution System:
   It is the interconnection network to form one logical network (ESS) based on several BSs.

6. Extended Service Set (ESS):
   It is a formed logical network of several BSs.