



the **medical industry** is creating the demand for devices that monitor physiological conditions and functions [4].

## 1.2. Communication Technology

The wireless system in WBSN uses medical bands to obtain physiological data from sensor nodes. The medical bands are selected to reduce interference and thus increase the coexistence of sensor node devices with other network devices available at medical centers. The collected data is transferred to remote stations with multi-hopping technique using medical gateway. The gateway nodes connect the sensor nodes to local area network and the Internet for global access. As such facilities are already available in medical centers; medical professions can access patients' physiological signals anywhere in medical center. The data can also be accessed outside the medical center as they will be made available on the Internet. Most popular wireless communication technologies and protocols proposed in medical monitoring systems are listed in Table 1. Existing monitoring systems use the short-range wireless systems such as ZigBee (IEEE 802.15.4) [5–7], WLANs [5,8], GSM [8] and Bluetooth (IEEE 802.15.1) [9–11]. To make the power consumption and the size of the device low, short-range devices like Bluetooth and ZigBee are mostly used with sensors to collect medical data from patient body. Especially WLAN technologies are avoided for low power sensor nodes because of their large size and power consumption used to provide longer ranges (i.e. 100 m). As these technologies may most probably be installed in medical environments due to other applications, medical gateway devices should be designed in WBSN to interface with these wireless systems to provide wireless link between control unit and mobile device (i.e. PALM) or between the control unit and Internet via Wi-Fi link. The low-data rate IEEE 802.15.4 technology (ZigBee) has been the most popular short-range standard used recently in medical monitoring systems due to its low transmitter power [12][13]. Medical Systems using Zigbee wireless platform may however suffer from strong interference by WLANs which share the same spectrum and transmit at larger signal power [14]. Installing an interference free medical network in hospital may thus be quite challenging since

there exist a lot of other wireless systems and equipment using 2.4GHz band.

**Table.1. Usage of wireless protocols in wireless sensor network applications**

| Protocols   | Zigbee         | WiFi            | Bluetooth     | RF            |
|---|----------------|-----------------|---------------|---------------|
| Operating power consumption   | 40 ma<br>3.3 V | 300 ma<br>3.3 V | 30 ma<br>3.3V | 14 ma<br>3.3V |
| Standby power consumption   | 15 ma          | 0.9 ma          | -             | 7-11.3 ma     |
| Interfacing Type  | UART           | UART            | UART /SPI     | UART /SPI     |
| Standalone type<br>Standalone can be used without externamicroc ontroller | no             | yes             | No            | No            |
| Frequency   | 900 - 928 MH z | 2.4 GH z        | 2.4 GH z      | 2.4 GH z      |
| Communication Type  | m2 m           | p2p             | p2p           | m2m           |
| Cose (LE)   | 420 LE         | 80 LE           | 75 LE         | 35-150 LE     |

The device technologies operating at 2.4GHz ISM band should thus deal with interference and coexistence issues when they are located in the same environment [13]. As can be seen in Table1, in addition to unlicensed ISM bands, there are medical bands such as MICS (Medical Implant Communication Service) and WMTS (Wireless Medical Telemetry Service) that are specifically regulated for medical monitoring by communication commissions around the world [12–14]. The recent short-range, low-data rate, ultra-wideband (UWB) technology is another attractive technology that could be used for body-area network applications because of its regulated low transmitter power [15]. For min Cost target: we can use WIFI or RF, whereas For min power consumption we may use RF. For min size we may use WIFI because it does not need MicroController but it has max power consumption so we scan use sleep mode And needs IP for every sensor, For long range and min power consumption we may use Zigbee















