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Development of a remote health care wireless sensor network based on wireless spread spectrum communication networks

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ABSTRACT

When medical technology, communication, and computers were developed and put into practice in the treatment and follow-up of remote health care patients, the difficulty of communicating with the medical team or patients was due to bandwidth limitations. Sending a significant volume of data between medical personnel and patients, as well as power usage, is not permitted. Wireless sensors use a direct spread spectrum based on CDMA, especially mobile wireless third generation with a wide bandwidth that can send large data such as multimedia between patients and doctors at anytime and anywhere. The wireless sensor network decreases the power consumption of the transmitter sensor and the receiver sensor by using binary transmission and multipath. The accuracy of the measurement depends on the bandwidth of the unit to calculate the time of arrival (TOA). The TOA forecasts come and go together to pass them to the receiver because of the delay of the MPC and the reduction of replicas of the initial signal. The diffusion time caused by the moving signal through barriers, adding a positive bias to the TOA.

1. Introduction

In Over time, wireless networking technology has continually developed and made its way more and more into all aspects of our everyday life. Medical technologies are an environment where the future can be encouraged through wireless networking. Two of the main concerns are access and cost savings in healthcare [1]. Wireless technology will help resolve these issues. Medical devices with wireless radio frequency (RF) perform at least one function by using wireless RF communications such as Wi-Fi, Bluetooth, and cell phones to promote the delivery of health care [2]. Telematics health is a growing problem that greatly improves patient lives, particularly in the elderly, disabled people and those with chronic diseases. In the last few years, the developments in ICT, mobile internet and connectivity anywhere have played an important role in modern healthcare solutions [3]. Mobile health (m-Health) provides geographic, temporary, and even organization-wide health services [4]. The MHS will address emerging issues in healthcare including chronic lifestyle conditions as well as high costs of current national healthcare systems, the need to access self-care for patients and families and the need for direct and unrelative access to healthcare. Mobile computing has become the key attraction for science and business communities since the introduction of mobile connectivity using smart mobile devices that support 3G and 4G mobile networks for data transport. It offers numerous opportunities to build mobile health (m-Health solutions that are successful. The new edge of healthcare advancement is M–Health [5]. Typical health surveillance and warning systems, clinical and administrative data collection, record maintenance, health care delivery services, patient information literacy, identification and prevention systems, drug-counterfeiting, and fraud systems have a strong effect on M–Health systems and their associated mobility features. Internet and Web services are to provide doctors and patients with authentic, pervasive interaction. At any moment and wherever a doctor or a patient can conveniently access the same medical record from the personal computer, tablet or mobile. In case of an emergency the patient can contact the doctor, or even have access, regardless of the time and location, to medical records or appointments [6,7]. Networks of the third generation (3G) provide cellular and Internet technology capabilities, two of the common networking technologies. The networks aim to give their users access to a wide range of functional, IP-based multimedia services [8,9]. In the healthcare field, mobile multimedia services and applications have enormous potential. Currently, as mobile multimedia services and applications are increasingly dependent on the healthcare industry, many problems remain [10]. The e-

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healthcare devices were designed primarily for monitoring physiological parameters such as body temperature, oxygen saturation level, heart rate, blood sugar level, blood pressure, etc. [11]. However with the evolution of wireless technology, there have been a range of variations and changes in e-healthcare systems. Three main sections 1) Medical Instrumentation Measures (Sensors), 2) Wireless Communication Networks, and 3) Medical Server & Databases as shown in Fig. 1. Biomedical application has been an important component in the use of contemporary data and communication methods for health care. The earliest mention of telemedicine in cardiology dates back to the early 20th century, when electrocardiographic information was first transmitted over telephone wires. Telemedicine is a distant medical procedure that allows people to collaborate and encourage their joint efforts through IT and telecommunications to diagnose or treat illness. This field requires multidisciplinary development especially in the use of telecommunications, computer science and medical data exchange and administration tools.

Medical servers and databases are remote computers that help medical personnel and hospitals analyze and Track vital signs and provide patients with adequate care in real-time. The server also helps telemedicine experts to track, organize, and help. It usually involves a server for health institutes, patient history and database, and the generation of services. The medical server has been researched in seven fields in accordance with the telemedicine server's features and inputs, which include environmental management, evaluation and assessment, collaborative fields, servers focused on security and privacy, large scale data collection, patient triage, and health facilities. In particular, for real-time and continuous health care monitoring, a general three-tiered, omnipresent telemedicine scheme based on the Wireless Sensor Network (WSN) was used. To remain remotely tracked in the wireless sensor network around or near the patient to make proper decisions by doctors and the physician team. In this study the focus is on a mobile wireless healthcare center focused on a wireless sensor network with direct spread spectrum technique to enhance bandwidth and energy efficiency to transmit more data such as text, voice, audio, image, and video between patients and medical teams in the medical center. Wireless networking networks support smart mobiles and the Internet, such as WiFi LAN and SIM card strategies, using 3.9 generation technology. In the telemedicine world, cellular phones, other wireless systems, and communications systems are employed in informing users or customers of preventive medical facilities, the wireless communication network (Gateway). Mobile wireless 3.9 generation and 4 generation have a broad bandwidth and the potential to work with Biomedical interactive information (e.g. emergency management, network management, environmental support (EAL)), integration and aggregation, therapy help and disease control, mobile user interface adaptation (MUI), decision support (DSS) framework and gateway for calculation and assessment The paper's fourth area focuses on spreading spectrum technical communication over and beyond WSN by either proposing the allocation of radio resources or by implementing a capacity sharing system with a priorities awareness and an algorithm of decision-making with several features that supports mobile patients and dynamically chooses the

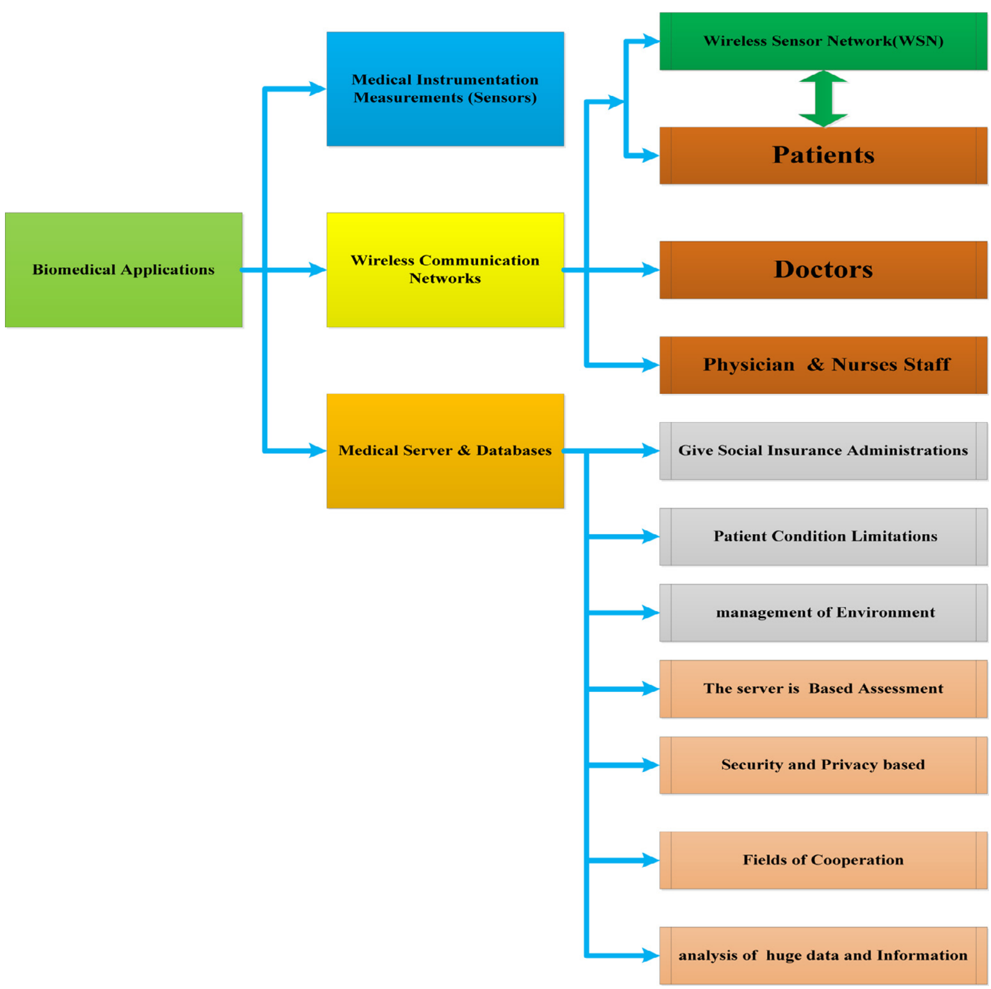

Fig. 1. Mobile wireless network-based biomedical applications integrated with the Wireless Sensor Network.

best network by ranking the applicants available. Different medical data were suggested for the multi-user sharing framework and a mobile ad hoc network-dependent solution was explored to resolve the problems of improving patient monitoring-related communication efficiency. In the healthcare field, big data is so extensive and complex as traditional electronic health datasets or standard data processing approaches and traditional software and/or hardware are hard to handle [12]. In such a scenario, the development of biomedical instruments, for the subsequent real-time monitoring and analysis of different signals can be assisted by new technologies such as Wireless Sensor Networks (WSN). Electronic health data for the monitoring, diagnosis and evaluation of persons in remote areas for care are all about telemedicine, which is also called e-health. This typically entails the use of modern communications equipment, including videoconferencing devices, for medical supplies. Tel-medical systems should evolve well emerging technologies like wireless communication can be disrupted or when a signal transmitted cannot be transmitted at the most appropriate location. Sensors are a major component of the network in each network of wireless sensors. An example is the temperature sensor which consists mainly of semiconductor materials which vary with changes in temperature. The skin temperature is detected in biomedical environments and the skin temperature can be monitored in the patient so we can provide immediate assistance [13]. In particular, the collaborative environment requires the incorporation into the virtual organization of a u-healthcare environment. Therefore, individual physical environments exchange data collected through WSN and improved healthcare data systems from sensors and PCs or systems that include a high volume of data and provide distributed and heterogeneous access solutions that fully satisfy user requirements under various circumstances. Wireless sensor networks consist of small electronic devices called nodes with the purpose of obtaining, translating, transmitting and receiving a specific signal collected by specific sensors, selected according to the sensing environment. The technology, for its low cost and power consumptions, is commonly used in industry, protection in shopping malls, hotels and crop fields, areas vulnerably affected by natural disasters, transport security and medical environments [14]. Regular protocols of MAC common to traditional wireless networks are Time Division Multiple Access (TDMA), Frequency Division Multiple Access (FDMA), Code Division Multiple Access (CDMA), and Carrier Sense Multiple Access (CSMA). Those taking pictures, logging on to the Internet, getting guidance and listening to radio through the built-in features or system sensors, and using an external device computer. Conventional MAC protocols cannot be expanded to sensor networks specifically for that purpose without any amendment. The basic characteristics of sensor networks, in particular energy efficiency and network scalability, must be taken into account when constructing an efficient MAC protocol for sensor networks. Furthermore, delivery latency, network efficiency, bandwidth utilization and fairness are also to be considered, but are of major importance in sensor networks [15,16]. In this analysis, the wireless sensor network to track patients with linked doctors and physicians medical team through the spread spectrum technique employed has broad bandwidth and low consumption power because it has a high signal-to-noise ratio and transfers large data to the medical center regardless of types of information, such as multimedia medical instructions.

2. Research methodology

New and innovative applications are being considered in the fields of medicine and healthcare as a result of wireless networking innovations. Some of those newly available apps and instruments in the medical sector are used to enhance applications from machinery management to hospital staff results. The subjects of mobile phone networks in the healthcare sector are discussed, such as long-term assistance for elderly patients and intelligent homes. Wireless sensors that remotely monitor heart rhythm and portable glucose monitoring devices are examples. With enhanced broadband and wireless technologies, the ability to benefit from developments in medical technology should be provided to all Americans. In order to ensure secure, efficient and safe service, organizations must incorporate and integrate broadband wireless network technologies and applications with medical appliance systems. The federal government must lead, encourage creativity and investment in innovative approaches to healthcare that allow patients, physicians and other health care practitioners to access the highest quality of care [17,18]. The American public, including industry, suppliers, patients and other stakeholders, should have access to specific regulatory protocols, procedures and guidance on marketing broadband and wireless medical devices. All types of wireless technology face challenges which coexist in the same room. Mobile wireless devices may communicate using either licensed radio spectrum or unlicensed in specified frequency bands. Licensed spectrum allows specific frequencies or channels to be used primarily in specific areas and in some cases, not exclusively. A patient remotely positioned can be remotely controlled through the transmission of their status to nurses in real-time. The translation of results from one device to another involves repetitive routines. Implantable devices in wireless networks are another hot subject. It is possible to implant these devices every day on normal wearable devices. Wireless sensors implanted within the body of the patient have their own important advantages. Patients use devices which track vital signs and report them in real-time to their doctors. Wireless sensor networks consist of small electronic devices called nodes with the purpose of obtaining, translating, transmitting and receiving a specific signal collected by specific sensors, selected according to the sensing environment [19,20].

2.1. Networks handheld wireless sensor

A wireless sensor network includes devices such as microcontrollers, sensors and receivers that form a network of various other nodes, also called motes or sensors. In any grouping, it is also necessary to know processing ability because communication includes the primary energy user, which means that some sensors need to be transmitted over long distances. This leads one to believe that greater energy consumption is required. In general, a node consists of four units inside the structure.

2.2. Processing unit

Normal protocol problems are collected as a frequency of use and types of specifications to be used on the basis of configuration variables (ZigBee, Bluetooth, and UWB, among others). This device consists of a short-range radio that is used outside the network to communicate with other nearby nodes. The radio can be used in the transmitter, recipient, standby and sleep mode. In this wireless device, multiple access code division (CDMA) based on spread spectrum technique uses wide band width and low consumption power to also transmit long distances of data.

2.3. Mobile sensors unit

This is a community of out-of-network sensors or actuators and link nodes Power consumption with low-energy materials can be projected to play an important role in today's real-world applications where sensor nodes are mobile. MWSN are far more potent than standard WSNs, as sensor nodes can be mounted and handle rapid changes in topology in any scenario. For example light, temperature, humidity, pressure/advanced etc. are used for moving sensor nodes and the power of batteries of the microcontroller, radio transceiver, and different sensors [21] [22].

2.4. Unit for energy storage

Energy efficiency is one of the main features in the wireless sensor network and has been identified by some research as a key metric. In the case of WSN hardware developers, different techniques should be given to minimize energy consumption. Because of this aspect, our network's power consumption must be regulated by two modules: 1) the battery module (measuring the energy consumption of different parts) and 2) (which uses this knowledge to measure the battery discharge). When the network has several nodes, battery replacement become very complicated, in this case the energy used for wireless communications networks is reduced below energy multiple hops (multi-hop routing) rather than a simple high-tech transmission as shown in Fig. 2.

The shared medium and variable topology are the key environmental factors in mobile wireless sensor networks. The medium shared indicates that control of channel access is important. The routing protocols are built with network topology and the data packet transmission path is also defined to reach the desired destination. Mobility models also project future node positions to define movements to/from the sensor nodes and how the position, speed and acceleration of the mobile sensor nodes change over time. Network Hybrid topology is the best way to solve these types of problems in large environments. In the collection of information hybrid topology plays also a major role, as network efficiency is also high. The routing procedures often define the effective and stable route of data transmission. Hardware costs, systems architecture, installation and battery energy storage costs, speed processing systems, dynamic topologies, sensor Knots/sink, covers, energy consumption, design protocol, scalability, local, core data/knots, hydrogenation, node failure, QoS, fusion/redundantness data. The nodes of the sensors have one or more sensors as general rule (such as tempering, illumination, moisture, moisture, pressure, brilliance, closeness, etc.), microcontrollers, external storage, radio transceivers, analog to analog transceivers (ADC), antennas and batteries etc. Because of their limited scale, the nodes again have insufficient buffer storage, battery power, transmission and radio bandwidth. But the mobile node layout is almost the same as that of a traditional sensor node. However, on mobile sensor nodes several other devices are considered, such as location-position identification devices, mobilizers or generators. The Finder method is used to determine the location or direction of the sensor node and the mobility of the sensor node. The power generator system is responsible for generating electricity to meet the extra energy demands of the sensor node by implementing some special technologies, such as solar cells, as shown in Fig. 3.

The MWSN is normally an autonomous and self-healing network consisting of an arbitrary topology generated by the wireless communication of mobile sensor nodes. A good coverage network ensures successful connectivity, greater network access, decreased energy consumption, and eventually, longer sensor node life [23–24]. The movement to/from mobile sensor nodes shift over time, speeds and accelerations was demonstrated through mobility. For design purposes, accessibility models are often used and are used to test new contact or navigation methods [25].

2.5. Topology of network

Network topology is of crucial importance in the MWSNs in transmitting data to mobile sink nodes. The web connects the platter and the user/server remotely. It guarantees a secure network and higher quality levels for mobility, traffic, end-to-end connectivity, and so on. MWSN topologies also describe the community portion of the sensor node, address new group members inclusion and exclusion of those who quit the group. Effective data collection and higher MWSNs can be provided by low energy usage taking account of these factors in a network topology. The latest WSN network topologies are hybrid/flat, tree, cluster and chain. Different topologies are managed to ensure the best possible data collection and network efficiency in accordance with the MWSN configuration. Different network topologies are used to ensure efficient data collection depending on the existence of the network (Fig. 4).

2.6. Routing protocols for MWSNs

The MWSNs can be grouped together into separated or hybrid routing methods. Efficient and effective designs of a MWSN routing protocol include heterogeneity, scalability and network topology security; node mobility sensor; power utilization; coverage of a network; methods of data transmission; QoS; synchronization; data aggregation and sensor node. Current routing protocols, including flat, hierarchical and position-oriented routing protocols, are classified according to their routing structures. Hierarchical routing can again be divided into classic and optimized hierarchical routing in large measure. In order to fulfill constructive, reactive, and hybrid routes, the path from source to destination is specified [26–30].

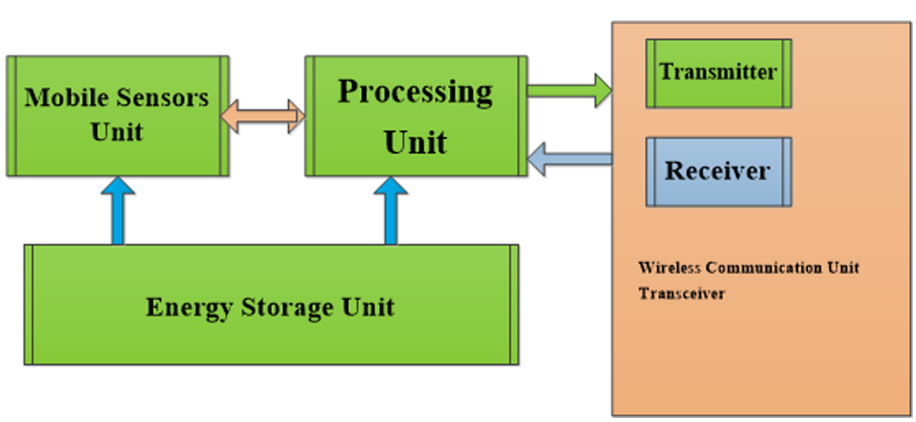

Fig. 2. Wireless sensor network system units.

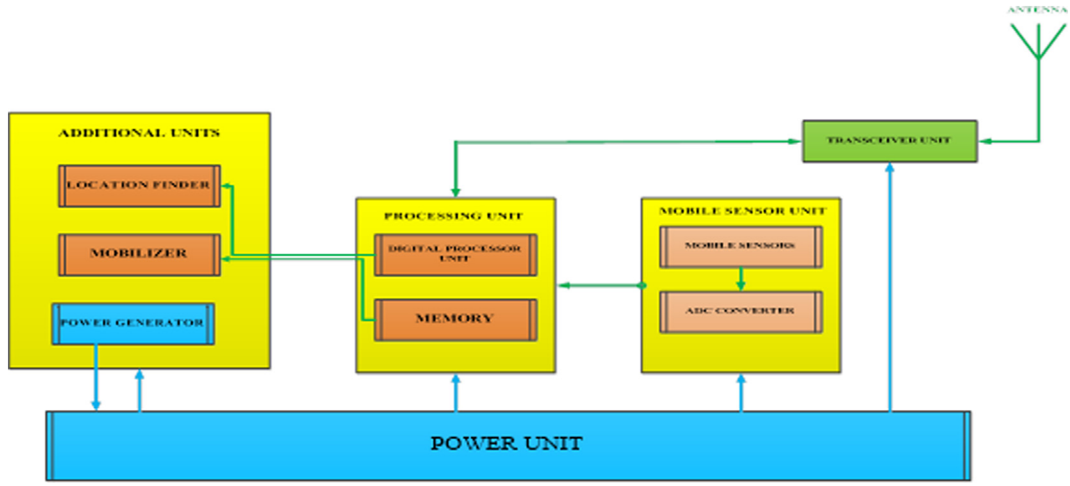

Fig. 3. Structure of the mobile sensor node system.

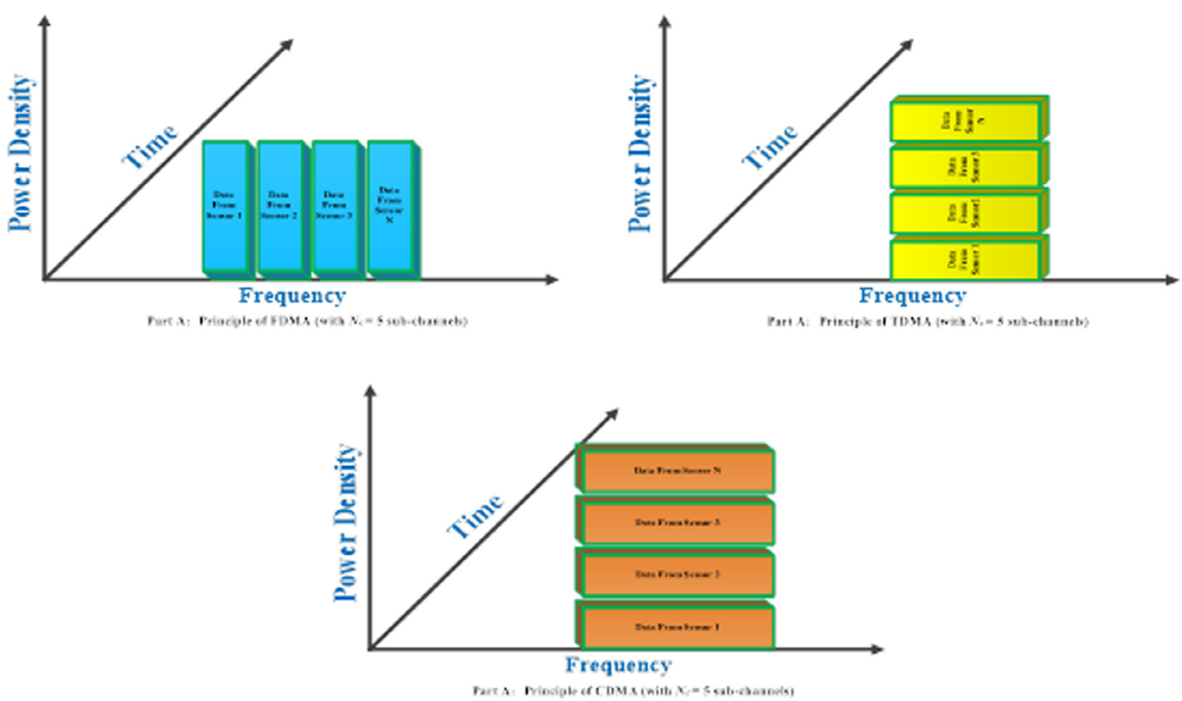

Fig. 4. Principle of, FDMA, TDMA, and CDMA (with 4 spreading codes).

2.7. Low energy adaptive clustering hierarchy (LEACH Variants)

LEACH is one of the most common dynamic clustering algorithms for hierarchical routing based sensor networks which is distributed fully and does not require global network expertise. In order to pick a cluster head, the sensor node uses the signal intensity acquired and threshold values and forms a cluster. For the transmission of data the ring or topology interval is considered, divided into fixed intervals of equal length. Each sensor node of the network will likewise serve as the head of the cluster by choosing a random number from 0 to 1 [31]. It's called a round the whole network operation. A configuration process consists of a cluster between the head and the sink of several shops and a static step for a loop (i.e. passing the data of the members of the cluster to the sink via the heads of the cluster. Intra-cluster and inter-cluster communication is a part of the LEACH data transmission mechanism. The cluster head collects data from participants in cluster discussions and instantly agrees with the data. Furthermore, dynamic clustering improves network longevity, and static leaching is not the optimal solution for wide mobile sensor networks; also, the versatility of leakage must be included in dynamic networks. Mobile sensor network LEACH variants including T-LEACH, the LEACH motive, and the LEACH-mobile system activated [32–34]. The components also switch off the radio even during transport times to reduce the energy dissipation of each sensor. Mobile LEACH reduces data loss on mobile nodes and results in a better output of LEACH. However, the agreement between Mobile LEACH and LEACH Mobile Multi-Hop has been suggested by Mezghani and Abdellaoui that it raises innecessary energy dissipation as opposed to the recommended MWSN Mobile LEACH mobile hop [34]. The mobile LEACH monohop, that is suitable for the tiny indoor environment, communicates directly with each mobile sensor node. The LEACH is also intended for some large outdoor applications with a lightweight Multi-hop [35]. The results of the simulation demonstrated the improvement of efficiency of heterogeneous MWSN in relation to Network life and the packet exchange rate, packets delay and loss rates in the suggested protocols (motive and static leach for single or multi-hops architecture). LEACH pursues only the residual energy content of the sensor nodes, so that LEACH is not appropriate for complex networks when selecting the cluster head for any one round. LEACH-ME maintains certain sensor node information, such as the node position, the mobility factor, the list of cluster members and the TDMA program. In terms of efficient average contacts, standard efficiency, device overheads and overhead energy, the simulation results indicate that LEACH-ME performs correctly in terms of mobility factor. The LEACH clustering-based protocol is used to overcome the constraints of the conventional routing and data propagation protocols that are run above unlayered or flat network architectures [36]. LEACH is based on an aggregation (or fusion) technique that combines or aggregates the original data into a smaller data size that carries only useful information of all in LEACH divides a network into many sensor clusters that are built not only to minimize the amount of data transmitted to the sink but also to make routing and Local coordination and control routing. LEACH's operation is divided into rounds, each of which has two main stages a set-up stage for clustering the network and a steady stage for sending data to the dish. These group heads are selected for themselves and are relayed to other network sensors with a certain probability. The decision for a sensor to become a cluster head is independent without any negotiations with the other sensors. Specifically, the sensor shall be a clusterhead dependent upon the desired cluster head percentage (P) (intermittent determination), the current time span, and the collection of sensors not cluster heads for 1/P rounds preceding. The head of the cluster, if < T(n), is a sensor, where T(n) is the equation threshold (1).

$$T(\boldsymbol{n}) = \begin{cases} \frac{\boldsymbol{P}}{1-\boldsymbol{P}(\boldsymbol{Rmod}1/\boldsymbol{P}} IFn \in G \\ 0Otherwise \end{cases} \quad (1)$$

Cluster headed sensors in round 0 during the following 1/P-1 runs are not a cluster. At round 0, the likelihood of each sensor being a cluster head is P. A sensor selects the closest one of all advertised cluster Heads who are going to have limited energy interaction and will then notify their cluster head of their decision by using the CSMA MAC protocol to join the cluster. In addition, the cluster heads should retain their recipients in order to listen to these calls. The sensors transmit their sensed information over short distances within a cluster, while cluster heads communicate directly with the sink. While LEACH helps the sensors slowly dissipate their energy into the cluster, the cluster heads absorb more power when they are farther away from the sink. The key issue with LEACH is sending it directly to the drain. In this case, the aggregate data from other cluster heads cannot be updated, however, it must only be transmitted to the sink [37].

Mobile Wireless Networks (Third Generation Code Division Multiple Access CDMA)

In addition to voice support for multimedia, data, and video, the third generation (3 G) of wireless communication aims to provide reasonably high-speed wireless communication [38]. High transmission speeds and multimedia support are the key features of 3 G systems developed in the early 2000 s. The ITU International Mobile Telecoms Initiative (IMT-2000) in 2000 described the view of ITU as voice quality comparable to the public switchable phone network for third-generation capacities, 144 kbps of data accessible in large-scale high-speed motor vehicle uses to large-scale users, 384 kbps accessible for small and slow movement pedestrians, 2.0 support to small scale users in motor vehicles. Using TDMA or CDMA to ensure spectrum efficiency and high capacity usage, the expected technology is generally digital. Improved streaming of audio and video, improved information speed many times, support for video conferencing, Internet and WEB browsing with greater speed, and support for IPTV (Internet TV). Long Term Evolution (LTE) is the standard for mobile telephones and data terminals for high-speed cellular data communication. Using a different radio interface, along with core network enhancements, improves capacity and speed. LTE's features include: 300 Mbit/s high-level downlink rates, 75 MBit/s high-speed uplink, service quality clauses (QoS) for radio access network transmission latency of less than 5 ms, 4 generation mobile devices that are able to manage moving quick-move devices, support scalable carrier bandwidths of 1.4 MHz to 20 MHz, and multiple orthogonal frequency access division (OFDMA) for d. 4 G provides higher rates of information and enhanced mobile broadband Internet connectivity multimedia facilities. The main functionalities of 4 G systems are higher 0.1/1 Gbps speed, higher security, higher power and lower costs than previous models. The systems include digital system voice over IP (VOIP) technology, IPv6 core, and OFDM multiplexing rather than CDMA. The removal of circuit switching, rather than using an all-IP network, is one of the main differences between 3 G and 4 G technologies [39–41]. One of the main issues in wireless sensor network architecture is media access control (MACFor the purpose of resolving this issue, a MAC protocol must be used to architecture mutual media access, to prevent data collisions from various nodes, and to share bandwidth resources equally and effectively between multiple sensor nodes. For the purpose of resolving this issue, a MAC protocol must be used to architecture mutual media access, to prevent data collisions from various nodes, and to share bandwidth resources equally and effectively between multiple sensor nodes. Different types of MAC protocols can be divided from different points of view: centralized and distributed single-channel and multi-channel, contention-free and non-contentious, etc. Typical MAC protocols that have been commonly used in conventional wireless networks are Time Division Multiple Access (TDMA), Frequency Division Multiple Access (FDMA), Code Division Multiple Access (CDMA), and Carrier Sense Multiple Access (CSMA). In the MAC without dispute, a typical medium is split in a number of subchannels in terms of time, frequency or orthogonal pseudo-noise codes. Single nodes with one subcannel occupied by each node are allocated these subcannels. This enables different nodes to access the common medium without interfering with each other, effectively preventing collisions of various nodes. TDMA divides the channel exchanged into a fixed number of time slots and configures them into a frame that repeats frequently. A time slot is assigned to each node and it is permitted to transmit in each frame only in the allocated time slot. In wireless cellular networks, TDMA has been used extensively.

The base station assigns time slots in each cell inside a standard cell system and provides time synchronization information to each mobile node. The base station in each cell in a conventional cellular system allocates time slots and provides all mobile nodes with time synchronization details. The main benefit of TDMA is its energy consumption, since it is possible to switch off certain nodes that do not transmit. However in contrast with other MAC protocols, TDMA has several drawbacks. TDMA, for instance, normally allows nodes in a cellular communication system to form clusters like cells. The scalability and adaptability to network modifications are minimal. Time synchronization is important for time slots as shown in Table 1.

In the presence of noise, the power of a CDMA is typically less than that of a TDMA device. Multiple access Code Division (CDMA) is a form of channel access used by various radio communication technologies. CDMA uses broadspectrum technology and a special coding scheme to allow multiplexing by several users on the same physical channel (where each transmitter is assigned a code) [42–43].

Table 1
Benefits and disadvantages of various methods of access.

Serial No.	Multiple Access Scheme	Benefits	disadvantages
1	FDMA	Low strength of the transmission Multi-track stable Facilities quick to schedule Low time of delay	The data rate at low peak Loss of bands of guard Responsive to interference with narrowband
2	TDMA	The large maximum rate of data High multiplexing value in the event of explosive traffic	High strength of the transmission Multipath adaptive Difficult frequency planning
3	CDMA	Low strength of the transmission Robust to multipath Easy scheduling frequency High scalability Low time of delay	The data rate at low peak Small capacity by sector due to interference with multiple access

Spread-spectrum communications

The spread spectrum technique may allow at least partial fulfillment of the above requirements. A multiple access scheme, based on the multiple access division direct sequence code (DS-CDMA), relies on the distribution of the data stream using a specified spreading code for any user of the time domain. This is discussed earlier. Since the mid-1950 s, systems for spread-spectrum were developed. The transmitted signal is spread over a wide frequency band far broader than the minimum bandwidth needed to transmit the transmitted information, simply one device through which the transmitted signal is spread. To disperse and recover the data at the receiver, a reception synchronized to the code is used as shown in Fig. 5. Multiple (DS-CDMA) Division direct hopping code sequence and Multiple Access (FH-CDMA).

The general concept behind DS-CDMA is that the information signal will be transmitted through the B-bandwidth where B≫ Bs are located The processing gain is defined as

$$P = \frac{B}{Bs} \quad (2)$$

The higher the gain in transmission, the lower the density of power one requires to transmit the information. If the bandwidth is very wide, the signal can be relayed like a noise. One basic design problem with DS-CDMA is that if a number of users are using the same power range, if their power is too high, other users on the recipient side will be masked by one user. Consequently, precise power control is an integral part of any DS-CDMA scheme. Pseudorandom noise (PN) codes with strong inter- and autocorrelation characteristics are used for signal propagation. A variety of chips are used to combine data and code to create a PN code. The code in which the signal was transmitted within the transmission is repeated in the recipient to retrieve the received signal and combined with the transmitter signal. The original signal can be retrieved after correlation if the inbound signal and the locally generated PN code are synchronized. Different PN codes distinguish user signals in a multi-user environment and the recipient needs only to know and coordinate with the user's PN code. This principle of user separation is known as DS-CDMA. More signals appear, the longer the PN code, the more noise. The drawback is that coordination becomes harder unless details such as pilot signals are sent to aid acquire. Frequency hopping (FH) is similar to direct sequence diffusion, where codes are used to spread the signal over a much wider bandwidth than is required for the propagation of the signal. The signal bandwidth, however, is unchanged and is hopped over a number of channels, each with the same bandwidth as the transmitted signal, instead of integrating the signal with a code to distribute the signal over a continuous bandwidth. While at any point, the transmission level may be higher than with DS-CDMA in any narrowband area, the signal may be present in a specific channel for a very limited period of time.

Is very difficult to detect. It is the PN code's job to ensure that all frequencies are used optimally in the total usable bandwidth. Slow frequency hopping (SFH) and fast frequency hopping are two kinds of frequency hopping: (FFH). A hop is used to transmit several symbols with SFH. There are lots of hops per sign, FFH means. FFH is more resistant to jamming, but because fast frequency synthesizers are required, it is more complex to implement. A hybrid DS/FH scheme could be suggested in order to minimize complexity. Here as in DS-CDMA, the signal is first transmitted over a bandwidth and then jumped over a number of channels, each with a bandwidth equal to the DS spread signal's bandwidth. This allows one to use a much greater bandwidth with the use of low cost available components than with traditional DS spreading. For example, if we have a 1 GHz spectrum available, it might not be possible to produce a PN code generator producing 10^9chips/s or hopping at 10^9hops/s. Alternatively, two generators of code could be used: for signal propagation and for hopping pattern production. It was possible to produce both codes using low-cost components [44].

3. Result and discussion

Multiple access Code Division (CDMA) is a form of channel access used by various radio communication technologies. To allow multiple users to be multiplexed over the same physical

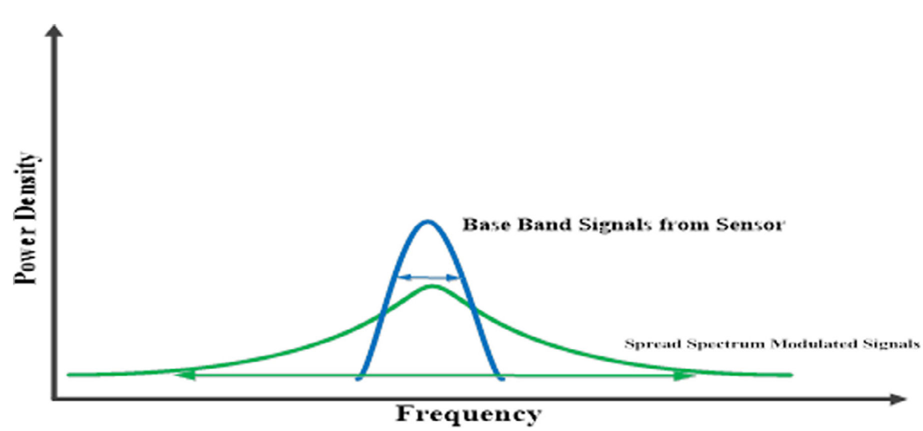

Fig. 5. Spectral density of power after direct spreading series.

channel, CDMA uses a wider range of technology and a special coding system (where a code is assigned to each transmitter Multiple access times (TDMA), on the other hand, divides access by time, while multiple access division of frequency (FDMA) divides access by frequency. Since the modulated coded signal has a much higher data bandwidth than the data being transmitted, CDMA is a type of "spread-spectrum" signaling. For one or more patients, the various sensors share the same bandwidth at the same time and distinguish the data by applying different user-specific spreading codes, i.e. the patient signals are segregated within the code domain. The theory of MC-CDMA involves mapping chips of the diffusion data symbol in the direction of frequency across parallel subchannels, while the MC-DS-CDMA chip of the spread data symbol is mapped in a time direction across many multi-carrier symbols. The chips of the user-specific spreading code multiply these sub-channels. Since the fading can be considered flat on the narrowband sub-channels, A single complex-value multiplication per subchannel can be achieved by simple equalization. As the spreading code length does not have to be selected equal to the number of sub-carriers, MC-CDMA provides versatile system architecture, enabling adjustable receiver complexities such as shown in Fig. 6.

The multiple carrier CDMA theory maps the chips of the symbol into frequency over multiple parallel subcarrying channels, while MC-DS-CDMA carries the chips in the direction of time by means of several multi-carrier symbols. MC-CDMA simultaneously transmits the user data symbol for several narrowband subchannels. The chips of the user-specific spreading code multiply these sub-channels. Since the fading can be considered flat on the narrowband sub-channels, easy equalization with a complex multiplication by subchannel is possible. As the spreading code length does not have to be chosen equal to the number of sub-carriers, MC-CDMA provides versatile device architecture, allowing for adjustable recipient complexities (Fig. 7).

3.1. Multiple access Division (DS - CDMA) direct sequence code

DS- CDMA produces a specific code which allows the users to differ between user signals in the PN sequence of each user. This allows multiple users to simultaneously transmit through the chip Rc bandwidth and distinguish their signals with their special PN codes. A transmitter copy of the PN chip sequence multiplies the receive signal and connects or filters it, as in any DSSS device. The client uses a PN code specific to the desired user signal in the CDMA system, which mostly reduces the signal with the code encoded by other users to a broadband noise.

3.2. Ideal CDMA power management

In this work, we quantify for the CDMA base station signals obtained in the wireless network as regards the number of sensors that share this channel simultaneously the signal at interference and noise ratio (SNIR). The SNR ratio varies from the signal intensity to the background and does not interfere with the sound source. The SINR may be related to the error rate requirements and other factors in the design of a digital cell system, if it has been measured. We believe that each transmitter's power is controlled by the central base station, so that from each terminal the same functionality is supplied and the power is constant over timeMoreover, we assume DS-CDMA systems in which M users send information at the same time to the base station, and the bandwidth of the standard channel is W = NRb = N/Tb. The other M − 1 is a broadband station. One of the users is Mobile "target". Both interferers have an overall interference power at the base station (M −1) EbRb is the additive noise power of N0W, so equation (3) is the gross interference at the base station plus noise.

$$\boldsymbol{Iav} = N0\boldsymbol{W} + (\boldsymbol{M} - 1)\boldsymbol{EbRb} \tag{3}$$

By equation (4) is given the power obtained from the target receiver.

$$\boldsymbol{Pav} = \boldsymbol{EbRb} \tag{4}$$

And the SINR is therefore given by equation (5).

$$\gamma = \frac{\boldsymbol{W}}{\boldsymbol{R_b}} * \frac{\boldsymbol{P_{av}}}{\boldsymbol{I_{av}}} = \frac{\boldsymbol{Eb/No}}{1 + [\frac{\boldsymbol{M}-1}{\boldsymbol{N}}](\frac{\boldsymbol{Eb}}{\boldsymbol{No}})} \tag{5}$$

M = 1 and γ = Eb/N0. If there are no interference and there exists only one user, when there is a high number of users, and all devices have the same power, interference noise dominates background noise. The SINR is then approximated by the equation (6).

$$\gamma = \frac{\boldsymbol{N}}{\boldsymbol{M} - 1} \tag{6}$$

For some desired SINRγ amount, the number of users is given by the equation (7).

$$\boldsymbol{M} = 1 + \frac{\boldsymbol{N}}{\gamma} \tag{7}$$

Bandwidth efficiency is defined as the total user data rate, standardized by the device bandwidth, which we write as an equation (8).

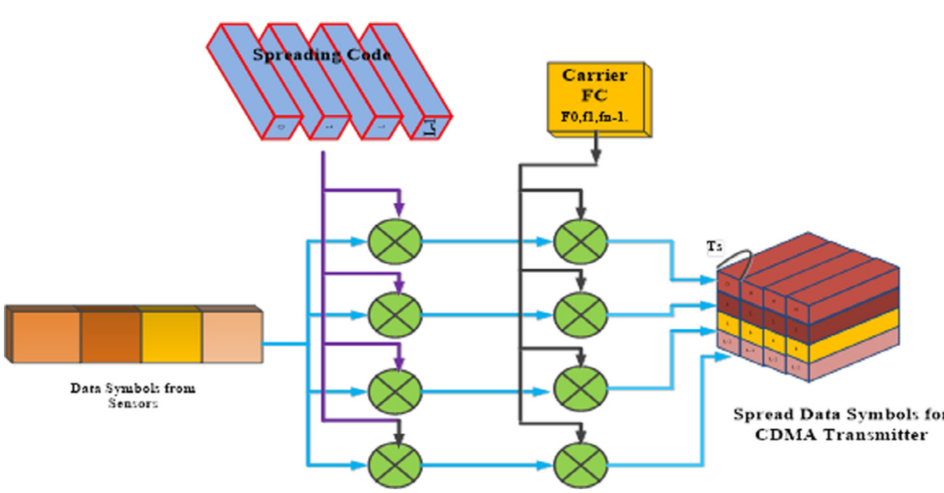

Fig. 6. Direct Spread Spectrum CDMA signal generation from medical sensors for one patient with multi - carrier.

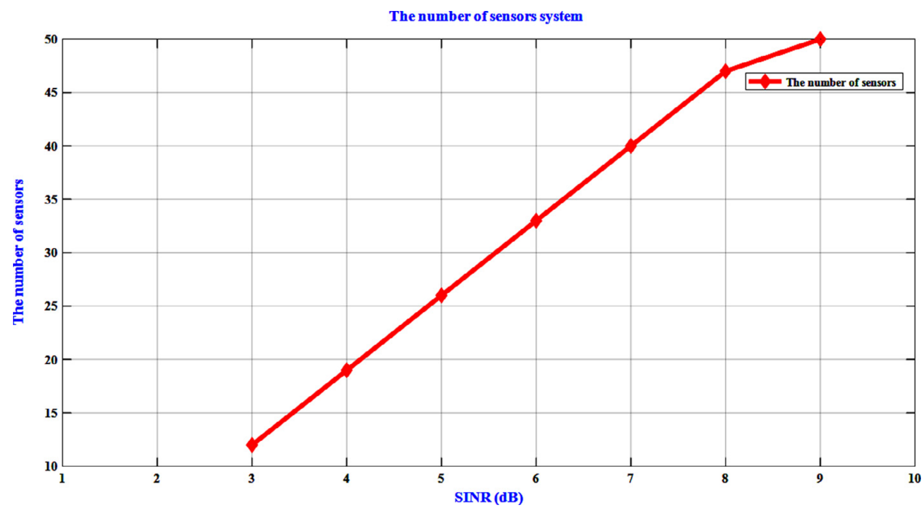

Fig. 7. Shows the number of sensors in the wireless sensor system with increased SINR (dB).

$$= \frac{\boldsymbol{MRb}}{\boldsymbol{W}} = \frac{\boldsymbol{M}}{\boldsymbol{N}} = \frac{1}{\boldsymbol{N}} + \frac{1}{\gamma} \quad (8)$$

The γ required value is based on the techniques of modeling and coding used in the unit along with related user error rate specifications. In this study we presumed every user terminal had the same signal power. Naturally, because of the decay the power obtained varies in the radio environment. However, if our ideal power control principle is applied to ideal instant power control, fluctuations in faded energy are not achieved. In general, the first concepts in Equations (7) and (8) are for emerging digital cellular networks. Both equations are much smaller than the second two terms and can be simplified further as equations (9) and (10).

$$\boldsymbol{M} = \frac{\boldsymbol{N}}{\gamma} = \frac{\boldsymbol{W/Rb}}{\boldsymbol{Eb/Io}} \quad (9)$$

And $= \frac{1}{\gamma} = \frac{1}{\boldsymbol{Eb/Io}}$ (10)

Fig. 8 shows that current CDMA digital cellular systems need SINR (3–9 dB) using QPSK modulation and convolutional coding, as the SINR increases to generate an increasing number of sensors in this device.

The number of sensors that the device will help in the practical design of wireless sensor systems is influenced by three other parameters, as well as the bandwidth performance of the system, as shown in Fig. 9. Bandwidth performance is increasing in the wireless sensor network as we increase the SINR in this device to deal with a lot of data in biomedical multimedia information without sensor power consumption

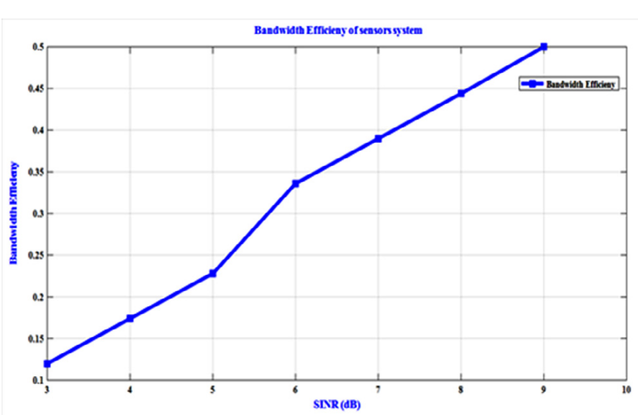

Fig. 8. BANDWIDTH performance in wireless sensor networks relates to SINR.

The data bit rate for capacity data is given by the Shannon equation (11) in the wireless sensor network. As the SINR increases, as seen in Fig. 10, the data bit rate also increases in this frame work, transmitting mobile wireless communication to pass more data between patients and doctors as biomedical multimedia.

$$\mathbf{C} = \mathbf{WLog_2}(1 + \mathbf{SNIR})\mathbf{Bitspersecond} \quad (11)$$

The comparative performance assessment of these technologies requires a framework because the number of RF location sensing applications is growing and numerous technologies are being developed. Any approach for estimating performance includes statistical models for the conduct of the sensor which describes a deviation from the expected value of measured metrics where the sensor worked ideally. The output of a system with the sensors density and use strategy is critical with such models. There are very different behaviors, so different models for different parameters must be created for different sensors using the TOA, RSS, AOA or deletion profile symbols.

4. Sensors of time of arrival (TOA) actions

Simple receptors without the bandwidth of the system may use RSS measurements, but distance-related RSS models are unreliable and complex. The calculation of TOA requires more complicated recipients in TOA systems, which depends on the bandwidth of the systems. For creating a mathematical model of the distance measurement error and for connecting it to the sensor bandwidth, the results of the radiation tracing calibration measurement program shall be used. Two separate models are built in the LOS and OLOS areas for both cases because their behavior. The distance error is regularized by the model as the error is proportional to the distance (12)

$$\gamma_{\boldsymbol{w}} = \frac{\varepsilon_{\boldsymbol{d,w}}}{\boldsymbol{d}} \quad (12)$$

In this manner, an equation represents the approximate distance representation (13)

$$\boldsymbol{d}_{\boldsymbol{w}}^{-} = \boldsymbol{d}(1 + \gamma_{\boldsymbol{w}}) \quad (13)$$

Modeling the error reduces the statistical characteristics of a typical distance measurement error based on bandwidth. This model splits the spectrum into LOS and obstructed LOS and (OLOS)

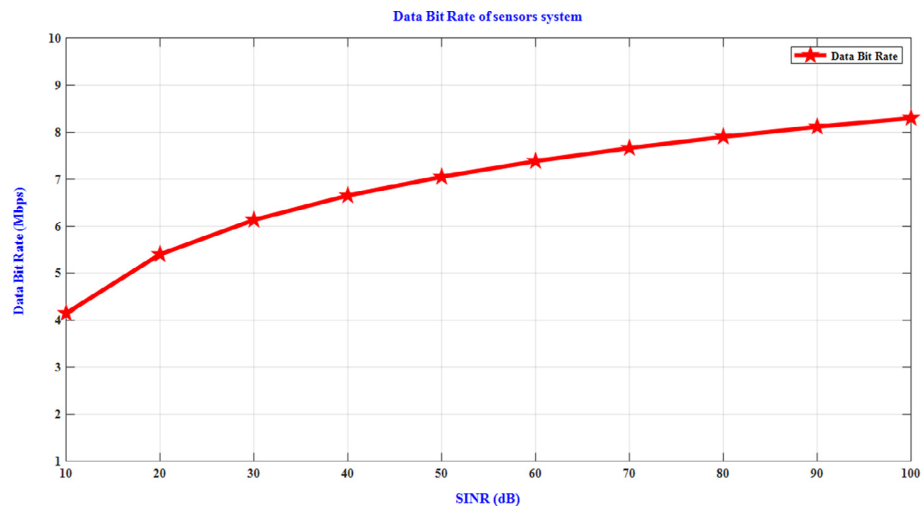

Fig. 9. THE data bit rate in the wireless sensor network of the mobile wireless communication system. Action Simulation of Radio Frequency (RF) Sensors.

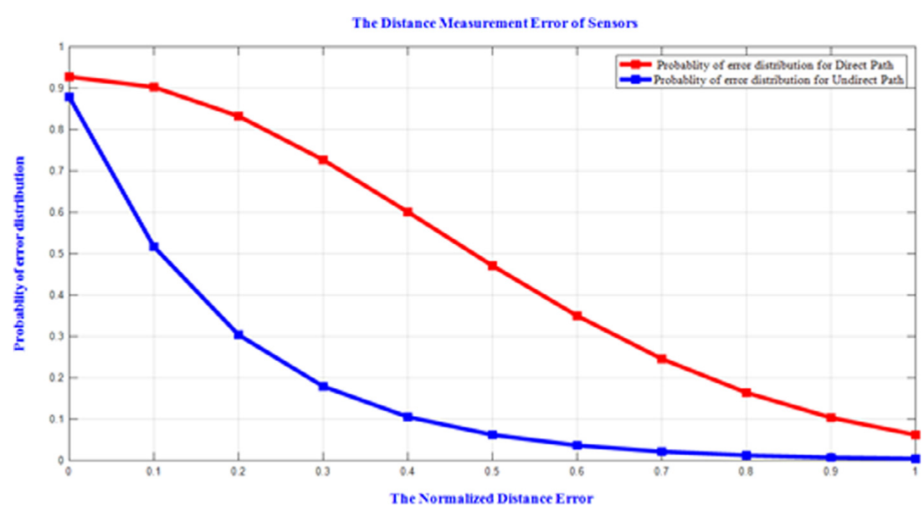

Fig. 10. Observed the Radio Frequency Line (LOS) and Obstructed Sight Line and distance Measurement Errors (OLOS).

areas and calculates the μL, W and αO, W distribution functions on a TOA sensor w bandwidth, respectively the standardized distance error in the LOS and OLOS ranges. For LOS, DP is always the strongest way and with a Gaussian equation distribution (13) the distribution functions of the normalized distance error are models (14)

$$(\gamma_{L.w}) = \frac{1}{\sqrt{2\pi}\sigma_{L.w}} e^{-\gamma_{L.w}^2/2\sigma_{L.w}^2} \tag{14}$$

And

$$\sigma_{L.w} = AL\left(\frac{1}{W} - mL\right)^2 + BL \tag{15}$$

The distribution of errors in OLOS areas is modeled as a combination of the Gaussian distribution and the exponential distribution given respectively by equations (16) and (17).

$$f(\gamma_{O.w}) = \frac{1}{\sqrt{2\pi}\sigma_{O.w}} e^{-\gamma_{O.w}^2/2\sigma_{O.w}^2} + W_{exp}\lambda e^{-\lambda\gamma_o} * U(\gamma_{O.w}) \tag{16}$$

And

$$\sigma_{o.w} = Ao\left(\frac{1}{W} - mo\right)^2 + Bo \tag{17}$$

Where AL = 52691, AO = 9052, BL = 0.43, BO = 2.6, mL = 0.0001 and mO = 0.16. and λ = 5.3, WG = 0.79, Wexp = 0.21. As the normalized distance error increases, the likelihood of error distribution decreases for both the direct path and the indirect path, but the guided path is greater than the undirected path since it affects radio transmission mechanisms such as reflection, diffraction and scattering. Fig. 10 shows the distance measurement error between sensors.

With the real distance of equation 10, That model normalizes distance error, we have direct wireless network sensor path estimate distance and equation (11), and we also got the undirected path distance estimate for the same device as shown in Fig. 11.

There is therefore a spatial distribution for the user of data rate, where one of the available multirate systems is connected to any region, if we consider an area covered by wireless data service. In other words, in a random location in the coverage field, the data rate forms a distinct random variable. Pn is the likelihood of the data rate, which is the ratio of the areas in which the data rate is unique to the total coverage zone of the access point (AP) or the base station depending on the distance between the sensors (BS). If the terminal is located at random in the coverage region, the probability of being in each area is given by the equation (18) of the ratio of the area to the specific data rate to the total coverage area.

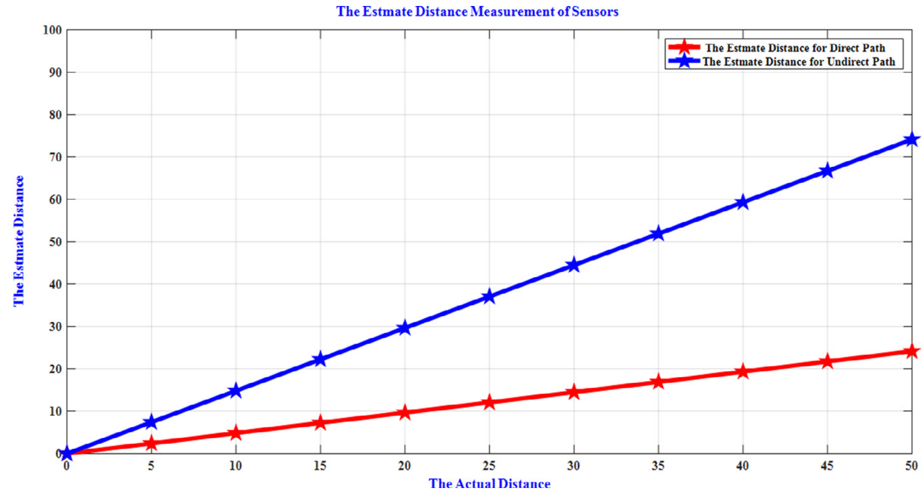

Fig. 11. The estimate distance measurement of sensors system.

$$P_n = \frac{A_i}{\pi D_{last}^2} \tag{18}$$

Where the Ai region increases the likelihood of coverage distance by meters when the coverage distance, also increases as seen in Fig. 12. The function of the probability density for the data rate is determined from the ratio of the data rate coverage area to the total coverage area.

This framework explains the impact of biomedical information transfer between patients and physicians on bandwidth in wireless sensor networks through direct spread spectrum to share all information to save these patients shortening distance in emergency conditions. Mobile wireless communication used by CDMA transports most information because it has a broad bandwidth and SIM card operator deals with the internet such as third generation or 3.9 generation and home wireless LAN. The multipath used in the wireless sensor network is a challenge that implies loss of sensor consumption capacity, but we can minimize it by choosing the strongest possible path such as direct path. If we have no line of sight, we can get the best obstructed line of sight and cancel others in working time and use binary data from the system. TOA measurement involves more complex receivers, and the precision of the measurement depends on the bandwidth of the device. TOA-based range output depends on the availability of the direct path (DP) signal. In the presence for instance, short distance line - of - sight (LOS) conditions, accurate measurements are possible. However in non-LOS (NLOS) situations, which can be described as site-specific and dense multipath settings, the difficulty differs. The TOA estimates arrive and integrate the estimation adjustment at the receiver because of the multipath components (MPCs), which are delayed and attenuated replicas of the initial signal. The loss of the DP, also known as undetected direct direction due to blockage (UDP). It is best to return to a standard model used to characterize the wireless channel in order to examine the behavior of the TOA dependent range. The transmitted signal will be dispersed in a standard indoor environment and the receiver node will receive replicas of the original signal with varying amplitudes, phases, and delays. The signals from all these routes converge at the receiver and this phenomenon is known as multipath. We use a model usually used to describe multipath arrivals in order to understand the effect of the channel on the precision of the TOA. For several years, one TOA estimation technique based on the wideband direct spread spectrum (DSS) signal has been used in GPS and other ranging systems. A signal coded by a known pseudorandom (PN) sequence is transmitted in such a device and a receiver cross - correlates the received signal using a sliding correlator or a matched filter with a locally generated PN sequence [45–46].

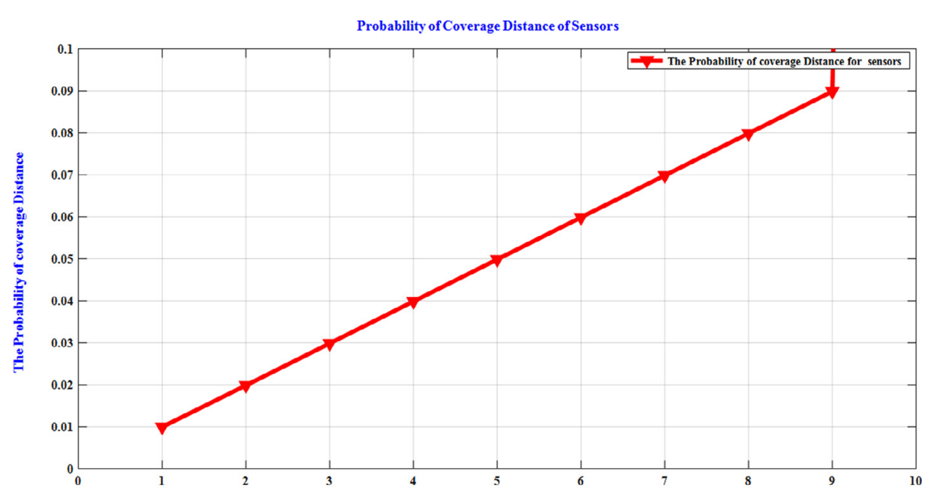

Fig. 12. The probability of coverage of wireless sensor networks with change distance sensors.

5. Conclusion

Mobile health (m-Health) provides space, time and organizational barriers to health programs. M−health solutions address emerging healthcare issues, including the number of chronic lifestyles, the high cost of current national care schemes, the need to facilitate self-care and to monitor patients' own healthcare, and the need for direct access to medical services irrespective of the location. Since mobile networking is implemented by smart mobile devices, which support 3G and 4G mobile data transmission networks, mobile computing has become the main attraction in science and business communities. It offers numerous opportunities to build mobile health (m-Health solutions that are successful). In particular, for real-time and continuous health care monitoring, a general three-tiered, omnipresent telemedicine scheme based on the Wireless Sensor Network (WSN) was used. To remain remotely tracked in the wireless sensor network around or near the patient to make proper decisions by doctors and the physician team. In order to explain movements to/from the sensor nodes and how the position, speed and acceleration of the mobile sensor nodes change over time, future node positions are also predicted by mobility models. Multiple Access Code Division (CDMA) is a type of channel access used by different radio communication technologies. CDMA uses broadspectrum technology and a special coding scheme to allow multiplexing by several users on the same physical channel (where each transmitter is assigned a code). Since the modulated coded signal has a much higher data bandwidth than the data being transmitted, CDMA is a type of "spread-spectrum" signaling. For one or more patients, the various sensors share the same bandwidth at the same time and distinguish the data by applying different user-specific spreading codes, i.e. the patient signals are segregated within the code domain. The TOA forecasts come together and transfer to the recipient since the multi-path components (MPCs) pause and attenuate replicas of the original signal.

CRediT authorship contribution statement

Jafaar Fahad A. Rida: Conceptualization, Data curation, Investigation, Methodology, Software, Software, Supervision, Validation, Visualization, Writing - original draft, Writing - review & editing.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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