Square-odd Scanning for WBAN to Reduce Detection Time

Rani Kumari, Parma Nand, Avinash Sharma, Rani Astya

Abstract*: System Lifetime is a standout amongst the most critical measurements in Wireless Body Area Networks (WBANs). The increasing population needs large medical staff for the excellent healthcare services. Using sensor netwok in medical field might help to issue of the limitation of the medical staff across the world. The nodes of the sensor network remains active at all times whereas the utilization period of the sensor nodes is only 20% of the total time. This results in high energy consumption. This results in need of an efficient scanning technique for WBAN with dynamic active period.. Wireless sensing network uses very light sensors which have very low energy backup. So energy saving is very significant in such type of network. In this paper we propose Square-Odd scanning (SO) technique. This technique is used to detect any object efficiently, and also it preserve significant energy in wireless sensor environment. It periodically switches the sensors between sleeping and awake mode. Square-Odd scanning is an improved method for scan the object. It focuses on reduction in detection time of any object and increase the life period of sensor. The performance of the Square-Odd(SO) approach is good than all other previous scanning algorithms in field of detection time of any object.

***Index Terms*: WSN; WBAN; detection time; SO.**

I. INTRODUCTION

The advancement within the technology desires the wireless body area network (WBAN) with the health care applications. The health care desires the continual observation of the patient and also the readings ought to be passed to the health care professionals. The BAN should be designed in such how that these necessities are often consummated. WBAN may be an edition of the Wireless sensor field.The main distinction is that the space coated by WBAN is a smaller amount as compared to the world coated by the WBAN. The distinction between the WBAN and also the WSN are going to be mentioned in next section. Within the WBAN numerous sensors nodes area unit deployed round the patient body. It's not recommended to deploy the nodes inside the bodypart of patient; the nodes are often planted over or round the body.

Sensors hubs may be deliberately placed on the material body create a bunch that's known as remote body territory system that may be used to assemble patient's basic signs. They have allowed the application in this area increasingly moved toward.

The BAN design is shown within the picture 1; all the native nodes within the BAN transfer the information to the bottom station that transfers the information to server via completely different connectivity. Different forms of sensors will be employed in the WBAN having different parameters will be planted on different components of bodyportion. The temperature detector will be planted to live the temperature go 32-40 ^{o}C with terribly low rate, same as the blood pressure sensors are plant to detect the pressure of blood ranging 10-400 mg/Hg with low data rate and so on.

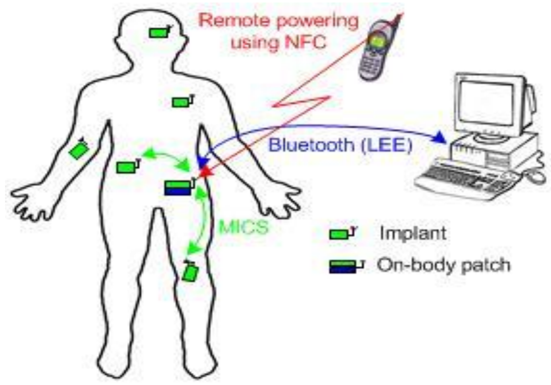


Fig 1:- Wireless Body Area Network Architecture

The primary contrast is the region secured by WBAN is less when contrasted with the zone secured by the WBAN. It isn't important to convey the hubs inside the assemblage of patient; the hubs can be embedded over or around the body.

Moreover, the sensor nodes remains active at all times whereas the utilization period of the sensor nodes is only 20% of the total time. This results in high energy consumption. This results in need of an efficient scanning algorithm for WBAN with dynamic active period. We propose a square-odd approach for improving the network life time. The performance of the Square-Odd(SO) approach is good than all other previous scanning algorithms in terms of network lifetime. All the previous techniques focus on energy consumption but our proposed work focus on reducing the detection time as well as energy consumption.

Revised Manuscript Received on May 22, 2019.

Rani Kumari, Computer Science & Engineering, Chitkara University, Baddi, India.
Parma Nand, Computer Science & Engineering, Sharda University, Gr. Noida, India
Avinash Sharma, Computer Science & Engineering, MMU,Ambala, India
Rani Astya, Computer Science & Engineering, Sharda University, Gr. Noida, India

*Published By:
Blue Eyes Intelligence Engineering
& Sciences Publication*

II. SCANNING ALGORITHMS

A. Always-Awake Scanning Algorithm

In the Always-Awake approach an improved style is engineered supported the consideration that a minimum of l/v sec. for associate in Nursing object to cover a body section whose length is l at a most speed v. So, all nodes (sensors nodes) within the body section will sleep along for l/v seconds that is outlined as silent span of the body network. When all sensor nodes get up at the same time for detection, then the silent time is zero. When the object is detected as shortly because the object enters the body section, then the detection time for all nodes is zero.

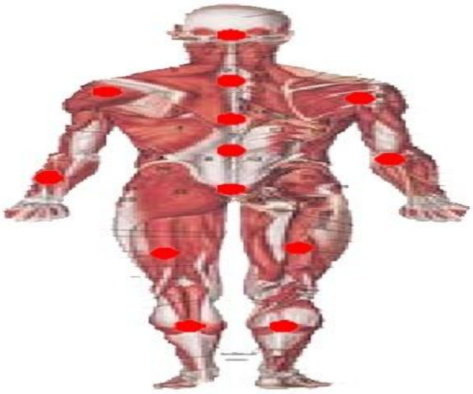


Fig. 2 Always-Awake scanning

Because the object is detect when it is enter the body segment. So the working time for the sensor T_{life} and the network life time is also T_{life}. Always-Awake Sensor network sleeps during the Sleeping Time T_{sleep}=0.

Advantage for Always-Awake approach:-

- The detection time is zero. So it reduces the detection time.
- Object detection is 100% for enter the scanning area.

Disadvantage for Always-Awake approach:-

- Low energy efficiency.

B. Duty Cycling Scanning Algorithm

In this approach the sensor should be work on the entire sensor network all the time but one sensor is silent that time. The sensor silent time is randomly process. So it may have to work in this type. If the object enter in the network area that time entrance node is silent then the object is enter the area. So the silent time is considered in the method. The detection time is depend on the entrance node if the object is enter the area that time sensor is active then detection time is zero and if the entrance node is not active then the silent time is considered.

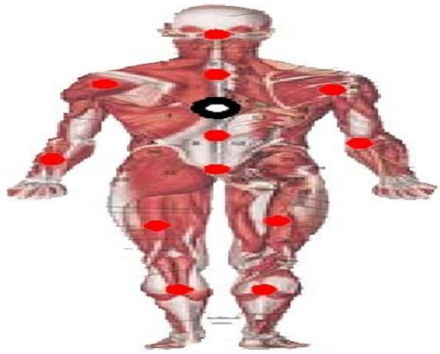


Fig 3 : .Duty cycling scanning

If an object enters in the body segment during the working time, then the finding time is 0.While, if an object enters in the body segment meanwhile the silent period, then the finding time is just1 /2 of the total sleeping time l/ (2v) seconds. So, the percentage of the sleeping span is l /(2v(wv+l).

Advantage of Duty Cycling approach:-

- It is improving the energy of sensor comparatively always-awake method.
- The detection time is zero or little one.

Disadvantage of Duty Cycling approach:-

- Energy is used more comparative to virtual scanning method.
- It uses maximum number of sensors.

C. Virtual Scanning Algorithm

When n devices or sensors area unit deployed on the body section therefore every node pass through the body segment length of l / v in average. However, the object will pass through the body segment either during scan period or silent period. After finding detection time of every node and so mix them to find average expected delay of l/(2v). Finally all sensors nodes goes in to sleep state for time period of l/v seconds, as in figure 4, we tend to activate devices one after one for operating time w from the right sensor s1 to the left sensor. So, this pattern of sensing give the surety for the detection of object and permits extra sleeping time for every individual node.

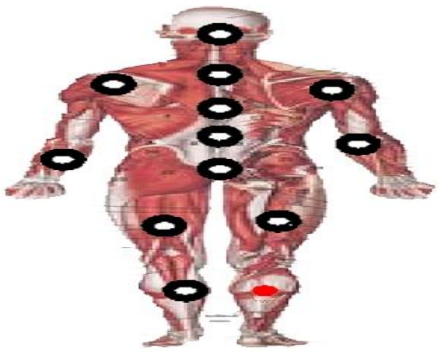


Fig: 4: Virtual scanning sensor network

Published By:
Blue Eyes Intelligence Engineering
& Sciences Publication

Advantage of Virtual Scanning approach:-

- It is improving the energy of sensor comparatively always-awake & Duty Cycle approaches.

Disadvantage of Virtual Scanning approach:-

- Detection Time is used more comparative always-awake & Duty Cycle approaches.

III. LIMITATION OF SCANNING ALGORITHM

All the above technique for scanning algorithms are basically based on graph theory and they are based on real life scanning process but they are far more complex then intrusion detection on scanning area . Some routes have multiple facilities on their way and some may various limitation of time and distance while choosing the right combination of the path. The navigation system which is described above have facilities view with some other landmark but there is a need to improve and extend the functionality of scanning algorithms. Hence there is a need to add some more functionality in the above algorithm so that they use in real life applications. Therefore time constraint has been included in the algorithms.

IV. PROPOSED SOLUTION: SQUARE-ODD (SO) SCANNING ALGORITHM

The WBANs are one amongst necessary areas where the two phenomenon

- Time dependent
- Energy effectiveness are necessary for everyone for detection area.

In this we propose a solution for scanning sensor network for a healthcare monitoring. To increase the network lifetime, they can mainly observe the sensing schedule of every sensor and improve the detection time for sensor, gives the surety of detecting of all objects before they create health issue.

Wireless sensing network uses very light sensors which have very low power backup. An algorithm "Square Odd(SO) scanning" is used to detect any object efficiently, effectively and also focus on the power consumption in wireless sensors. It periodically switches the sensors between sleeping and awake mode while the detection of objects(targets), enter from the right side or entrance point(E). Here user detects the object which are moving in the scanning area, saves power consumption and then increase the total life time of network.

WBAN systems have main focuses on sensors for the moving object where we apply the scanning technique for target detection which is the main feature of the network. In this, for w seconds node goes in to wake up state simultaneously. and n sensors are linearly placed at the body segment.

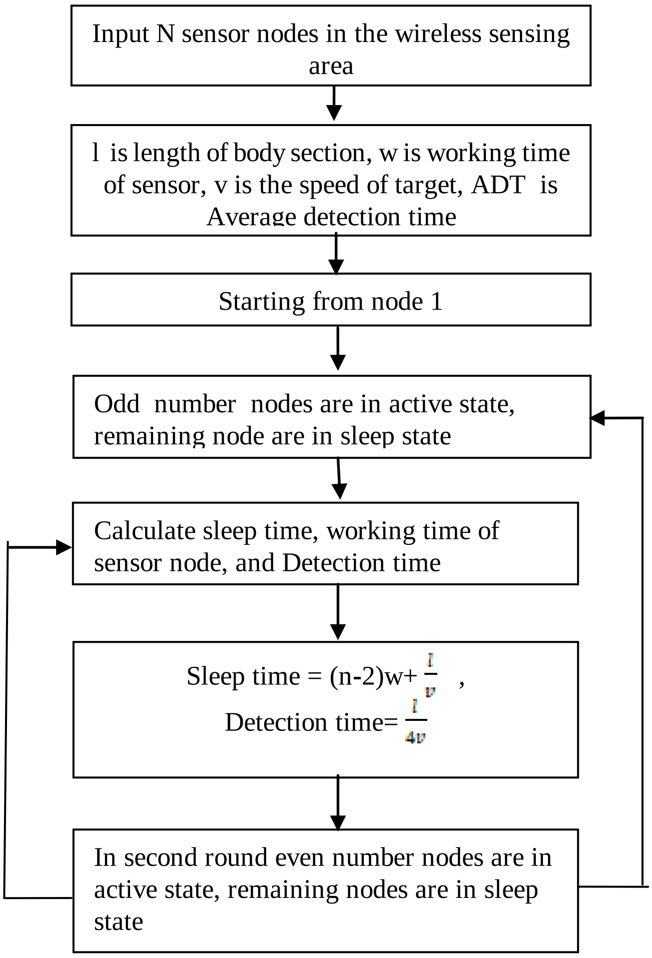


Fig 5:- Square – odd scanning algorithm to reduce detection time of object

V. MATHEMATICAL FORMULATION

In this we consider the following parameters for scanning of network. The parameters are shown in table.

Published By:
Blue Eyes Intelligence Engineering
& Sciences Publication

Table 1:- Parameters for network scanning

Notation	Definition
• T_{silent}	Time in which sensor node goes in to resting state
• T_{life}	Lifetime of individual sensor node
• T_{period}	Addition of scanning time and quiet time
• T_{sleep}	Time in which sensor goes in to resting state for a short period
• T_{net}	Lifetime of entire network system
• T_{scan}	Time in which scanning wave passes through the body
l	Length of body section
w	Working time of sensor
v	Speed of target node

VI. AVERAGE DETECTION TIME IN SQUARE-ODD SCANNING

We determine the Average Detection Time (ADT) for Square-Odd checking approach in a human body fragment. At to start with, for lucidity, we accept infection speed is consistent, the similar as with the greatest speed v.

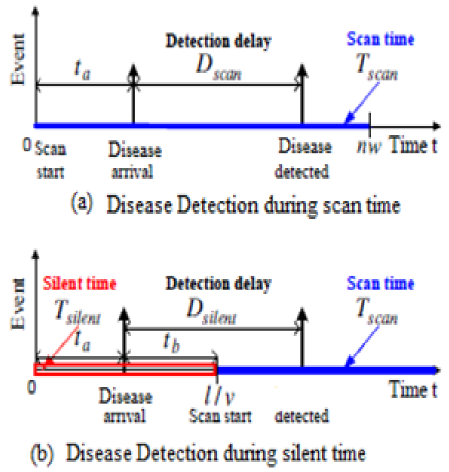


Fig 6: Disease detection case during scanning for body area

Enter during Scan Time: at the point when ailment enters meanwhile the output period Tscan. However each and every hub covers human body fragment whoselength is l/n, the square odd approach check wave moves with the human body portion and the speed vscan is l/(nw). The corresponding speed for the output wave and for infection is l/(nw) + v. Assume that any object or disease enters in the network or body after the beginning of scan, the sweep wave has officially voyage l/(nw). Hence it consumes (l – l* nw)/(lnw + v) seconds and after this output wave achieves the body fragment, it is called identification postpone Dscan. Incorporated the over the interim [0, nw], expected recognition delay (indicated by E[Dscan]) meanwhile check time is:

$$E[D_{Scan}]= \int_0^{nw} \frac{(nwl-lt)}{2wv+l} + \frac{l}{2nw} dt_a \, .$$

$$= \frac{nwl}{4(nwv+l)} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (1)$$

Enter during Silent Time: Protest enters during the noiseless time T_{silent}. Assume that the beginning of noiseless period starts and then any disease enters with time t_a. As appeared in picture, so it enters before the beginning of sweep at tb, the protest has effectively voyage t_bv. Hence it consumes (l − t_bv)/(l nw + v) seconds and after that the sweep wave achieves the protest on the human body. For this recognition delay, we additionally need to tally the object development time t_b alongside the past identification delay after the beginning of the output.

$E[D_{silent}]$ for silent time:

$$E[D_{silent}] = \int_0^{l/v} \frac{(nwl-lt+l)}{2wv+l} + \frac{l}{2nw} dt_a$$

$$= \frac{nwl}{4(nwv+l)} \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad (2)$$

we get expected ADT after combining these two equations with the square odd scanning.

$$E[D] = \frac{nw}{4(nw+l/v)} E[D_{scan}] + \frac{l/v}{4nw+l/v} E[D_{silent}]$$

$$= \frac{l}{4v} \quad \ldots\ \ldots\ldots\ldots\ldots\ldots\ldots\ldots (3)$$

VII. ALGORITHM ANALYSIS

There are several sensor nodes which shown in figure 7, it may be describe the process of the examine graph. User can create a Scanning procedure like a sub graph. In this user describe the scanning procedure:

Step 1: Here user may choose the one entering point and one protecting point from the different points of entrance and protection points of the graph.

v1→Source point or node (protection point)

v13→Destination point or node (Entrance point)

Step 2:The scanning mechanism as define as, it may commencement from the right of protecting point and the sensor point for first v1 and v3 in working condition at a time since all other remaining points are in sleeping mode.

Step 3: The scanning period for every sensor is w (fixed time) and for scanning complete nodes, it just shift to the active position for v2 and v4 sensor node ,and after that v3 and v5 nodes of sensing area are in active position.

Two sensor remains in wake up position at the same time so the object is detect definitely, and it will increase the performance and energy level. As well as it will increase the performance of Square-Odd scan method. So, for this we have create a sensor network with 13 nodes, in which only two nodes are active at a

Published By:
Blue Eyes Intelligence Engineering
& Sciences Publication

time and remaining nodes are in sleep state.

Scanning process:-As we have explained in previous section, proposed Square-Odd scanning algorithm for wireless body area network with network lifetime and time dependent phenomenon. There are many entering point and protecting point; it may be explain the process of the scanning graph. In this user defines the process of scanning:

Stage 1 :- There are n number of sensor nodes are positioned in the detecting zone. Every sensor is dynamic on the active time w second. v is speed of target is entering in the detecting field. The E is indicating the passageway hub and P is signifying the insurance hub in the detecting territory.

Stage 2 :- When the object enter in the detecting territory. On the off chance that sensor is dynamic at that point target is distinguished generally target is keeps running.

Stage 3 :- There are two sensors dynamic at any given moment in detecting region. On the off chance that sensor distinguishes the objective then it send signs to server hub.

Stage 4 :- The location time ought to be lessened and enhance the vitality of sensor.

So, for this we have create a sensor network with 13 nodes, in which only two nodes are active at a time and remaining nodes are in sleep state. The complete sensor network for scanning is shown in figure 7:

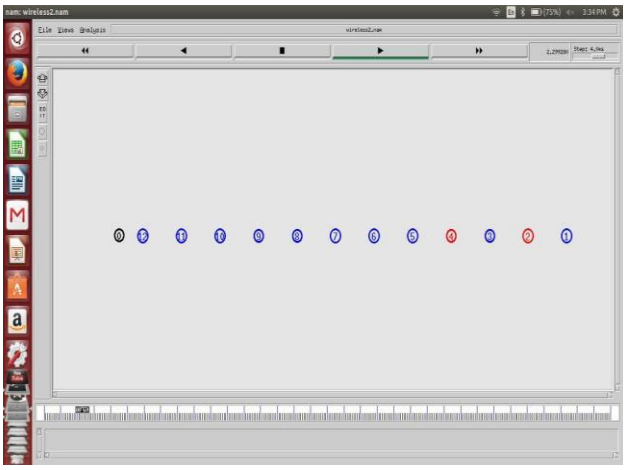
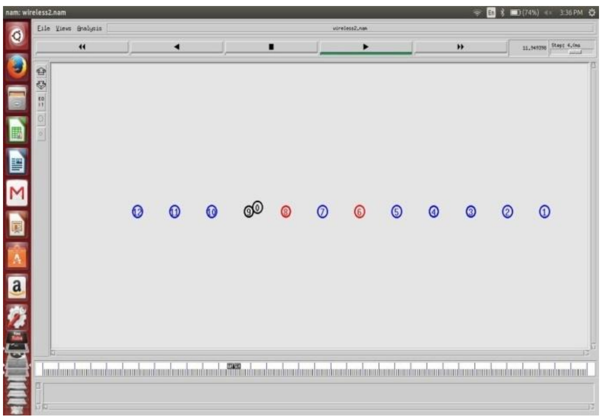


Fig 7:- Network area for scanning sensor detection

As shown in figure 8, when scanning start from right to left for detecting object then first sensor 1 and 3 are in active state, after that 2 and 4 nodes are active, then 5 and 7,then 6 and 8 and so on. Sensor nodes with red color represent the active state of sensors and blue color represent the sleep state



of sensors. When target object is detected then it also change the color of that target node to black color.

Fig 8:- Objet Detection

A. Analytical Detection Time comparison

There are many several approaches of scanning, Square-Odd scanning, Duty Cycling scanning, Virtual Scanning(VS) and Always- Awake scanning can provide surety for the finding of targets. In this section we compare the common detection time once an object entering into a Bodyphase among the Square-Odd, Always-awake scanning, Duty Cycling scanning and virtual scanning technique. In the sensing block, detection period to be improved in SO scanning method as compare to in virtual scanning technique.

- Always –awake Scanning: - When the object is detected as presently as a result of it enters the Bodyphase, then the finding time is zero. As a results of object is find once it's enter the Bodyphase.

- Virtual scanning: - When the n sensing element is placed on the Bodyphase so each detector passes through the length of l / n. Thus vv is the object speed and a target can gain any span that is the time of arrival is equally distributed. Thus the target can enter in the scan period or silent period. The average detection period for each quantity then concatenate them to induce total expected delay l/(2v). So, Virtual scanning(VS) finds the target with a fixed l/(2v) delay without effecting by the working time w.

- Square-Odd Scanning:- In square-odd (SO) scanning method, only two sensor nodes are active at a time. Once the n sensor nodes are entered in the body segment whose length is l and the speed of target is v. The average detection time for each sensor can be achieved by the quantity l/(4v). So, Square-Odd (SO) scanning detects the object with a constant delay l/(4v) without effecting by the working time w.

We note that the difference of detection time between the four techniques. We've need to make a case for the delay with Always –awake(AA) technique for finds with null delay. Duty Cycling tends decrease slowly while operational time w can increase. Virtual scanning (VS) finds with a seamless delay l/(2v) in place of operating time w. Whereas Square-Odd scanning technique detects the object with a constant delay of l/(4v) regardless of any change in the working time w.

Published By:
Blue Eyes Intelligence Engineering
& Sciences Publication

Table 2:- Average detection time for four techniques

Approach	Sleep time (T_{sleep})	Working time (T_{work})	Average detection time
Always-Awake scanning	0	T_{life}	0
Duty Cycling scanning	$\frac{l}{v}$	W	$\frac{l^2}{(2v(wv+1))}$
Virtual Scanning	$(n-1)w+\frac{l}{v}$	W	$\frac{l}{2v}$
Square-Odd canning	$(n-2)w+\frac{l}{v}$	W	$\frac{l}{4v}$

Reduce the Detection Time :-

There are different types of approaches of scanning Square-Odd, Duty cycling (DC), Virtual Scanning(VS) and Always- Awake will give surety of the finding of target.

For example, we assume that there are 20 sensor nodes with lifetime of 1 hour and the speed of target is 2 meter per second and the length of body segment is 5 meter.

So, n=20 sensors, T_{life} = 1hr.=3600 seconds,
v= 2 meter/second, l = 5 meter.

Now we find the average detection time (ADT) for every scanning technique for different values of w (working time of sensor node).

Table 3:-Average Detection Time Comparison of four approaches

W	Always-Awake	Duty-Cycling	Virtual Scanning	Square-odd
0.1	0	1.20	1.25	0.625
0.2	0	1.15	1.25	0.625
0.3	0	1.11	1.25	0.625
0.4	0	1.07	1.25	0.625

Square-Odd filtering identifies with a consistent l/(4v) delay and Virtual checking recognizes with a steady l/(2v) delay without affecting of active time w.

On the opposite side, the regular discovery period of the obligation cycling method tends to diminish while active time w increment. The constantly alert technique distinguishes the objective immediately.

Fig 9:- Graph representation for reducing the detection time

For example**,** for working time w=0.1sec, square-odd has the lowest detection time of 0.625 sec, as shown in table 3 and figure 9, which is better than other three scanning algorithms. Therefore, virtual scanning method has approximate same performance as duty cycling, Virtual Scanning technique can give 1.25 second on the expense of double longer average finding time. Duty Cycling has detection time of 1.20 sec, and the detection time for Always-Awake is zero.

For w=0.2sec, square-odd has the same detection time of 0.625 seconds, virtual scanning has the detection time of 1.25 sec ,Duty Cycling technique has detection time of 1.15 sec, and Always-awake has zero detection time.

Similarly, for w=0.3 second and w= 0.4 second , we get the lowest detection time for Square-Odd scanning technique as compare to other three scanning algorithms. For active time w = 0.4 seconds, the virtual scanning (VS) technique detects the object within 1.25 seconds in average and the (DC) duty cycling technique does within 1.07 seconds.

So, according to this performance Square-Odd scanning method is best in terms of detection time of target. This result is shown in figure 8.

VIII. CONCLUSION

Experimental and simulation outcomes present that the our proposed approach gives better result in both fields i.e. increase network lifetime and reduce detection time as compare to other existing techniques. Performance results of Square-odd scanning technique are shown in graphs and tables for different values of sensor's working time. So with Square-odd scanning technique, we can easily scan the sensing area for detecting our object or target with reducing detection time and after reducing detection time, the power consumption is low so, the total network lifetime will be increase.

IX. FUTURE WORK

- This work can be extended in the field of heart beat detection in BAN. When any heart patient on ventilator and at that time it is most required to detect the heart beat position of patient and other dangerous disease at early stage.

Published By:
Blue Eyes Intelligence Engineering
& Sciences Publication

- To detect multiple diseases, we scan sensor network at many times because only one disease can detect at a time. But it takes more power consumption of sensors and increase work load. Currently we have worked with this algorithm to detect only one disease at a time. It can be extended to detect more than one disease or multiple diseases at a time for early recovery of patient.
- This algorithm can be used to detect gas leakage in gas plants where sensors are applicable to detect the leakage position of gas at early stage.
- To detect disease in moving body is more complex as compare to static body. This work can be further used in detection of any disease in moving object or in moving body.
-

REFERENCES

1. Chen, M.; Gonzalez, S.; Vasilakos, A.; Cao, H.; Leung, V.C.M. Body area networks: A survey. J. Mob. Netw. Appl. 2011, 16, 171–193.
2. Liu, B.; Yan, Z.; Chen, C.W. Medium Access Control for Wireless Body Area Networks with QoS Provisioning and Energy Efficient Design. IEEE Trans. Mob. Comput. 2017, 2, 422–434.
3. Raffaele, G.; Parastoo, A.; Hassan, G.; Giancarlo, F. Multi-sensor fusion in body sensor networks: State-of-the-art and research challenges. Inf. Fusion 2017, 5, 68–80.
4. Fortino, G.; Gravina, R.; Raffaele, G.; Philip, K.; Roozbeh, J. Enabling Effective Programming and Flexible Management of Efficient Body Sensor Network Applications. IEEE Trans. Hum. Mach. Syst. 2013, 1, 115–133.
5. Riccardo, C.; Flavia, M.; Ramona, R.; Chiara, B.; Roberto, V. A Survey on Wireless Body Area Networks: Technologies and Design Challenges. IEEE Commun. Surv. Tutor. 2014, 3, 1635–1657.
6. George, S.; Nikos, D.; Rosario, S.; Valeria, L.; Fortino, G.; Yiannis, A. Decentralized Time-Synchronized Channel Swapping for Ad Hoc Wireless Networks. IEEE Trans. Veh. Technol., 2016, 10, 8538–8553.
7. Deepak, K.S.; Babu, A.V. Improving energy efficiency of incremental relay based cooperative communications in wireless body area networks. Int. J. Commun. Syst. 2015, 1, 91–111
8. Gomathi, C.; Santhiyakumari, N. OFSR : An Optimized Fuzzy Based Swarm Routing for Wireless Body Area Networks. In Proceedings of the IEEE SPIN 2016, Noida, India, 11–12 February 2016; pp. 507–512.
9. Dae, Y.K.; Wee, Y.K.; Jin, S.C.; Ben, L. EAR: An Environment-Adaptive Routing Algorithm for WBANs. In Proceedings of the IEEE ISMICT 2010, Tainan, China, 27–29 October 2010.
10. Ishtaique ul Huque, M.T.; Munasinghe, K.S.; Abolhasan, M.; Jamalipour, A. EAR-BAN: Energy Efficient Adaptive Routing in Wireless Body Area Networks. In Proceedings of the IEEE ICSPCS 2013, Carrara, Australia, 16–18 December 2013.
11. Elias, J. Optimal design of energy-efficient and cost-effective Wireless Body Area Networks. Ad Hoc Network.
12. Rani Kumari, Dr. Parma Nand "Performance Comparison of various Routing Protocols in WSN and WBAN" IEEE Conference on Computing, Communication and Automation held on 29th -30th April 2016 at Galgotias University, Greater Noida(*ICCCA 2016*).https://doi.org/10.1109/CCAA. 2016.7813814.
13. Rani Kumari, Dr. Parma Nand "An optimized routing algorithm for BAN by considering Hop-count, residual energy and link quality for route discovery" IEEE Conference on Computing, Communication and Automation held on 5th -6th May 2017 at Galgotias University, Greater Noida (*ICCCA 2017*).https://doi.org/10.1109/CCAA.2017.8229884
14. Rani Kumari, Dr. Parma Nand "To improve the performance of routing protocol in mobile WBAN by optimizing the scheduling mechanism" International Journal of Emerging Research in Management and Technology (IJERMT) ISSN–2278-9359 Vol. 6 issue. 9, September 2017. (UGC approved Journal)
15. Rani Kumari, Dr. Parma Nand "Performance Analysis of existing Routing Protocols" International Journal of Scientific Research in Computer Science and Engineering (IJSRCSE), ISSN-2320-7639, Vol. 5 No. 5, October-2017.(UGC approved and Thomson Reuters indexed Journal)https://doi.org/10.26438/ijsrcse/v5i5.4750
16. Rani Kumai, Dr. Parma Nand, "Performance Analysis of existing MAC and routing protocols for WBAN" IEEE sixth international Conference on system modeling and Advancement in system trends held on 29th - 30th December at Teerthanker Mahaveer University, Moradabad (SMART-*2017*).
17. Rani Kumari, Dr. Parma Nand "Secure Communication using PFS in a distributed Environment" On-line International Conferences on Ancient Mathematics and Science for Computing held on 24th-25th November 2017.
18. Rani Kumari, Dr. Parma Nand "RecentResearch onWireless Body Area Networks: A Survey" published in International Journal of Scientific Research in Computer Science, Engineering and Information Technology (IJSRCSEIT),ISSN- 2456-3307,Vol. 3 No. 1, January 2018. (UGC approved and Thomson Reuters indexed Journal).
19. Rani Kumari, Dr. Parma Nand "Performance Analysis for MANETs using certain realistic mobility models: NS-2", International Journal of Scientific Research in Computer Science and Engineering (IJSRCSE),ISSN-2320-7639, Volume 6, Issue-1, February 2018,(UGC approved and Thomson Reuters indexed Journal) .https://doi.org/ 10.26438/ ijsrcse/v6i1.7077.

AUTHORS PROFILE

Ms. Rani Kumari pursed Bachelor of Technology from UPTU of Lucknow,in 2008 and Master of Technology from IET in year 2010.She is Gold Medalist in M.tech. She is currently pursuing Ph.D.. She is working as Assistant Professor in Department of Computer Science, Chitkara University,Chandigarh. She is a member of ACM since 2016. She has published more than 25 research papers in reputed international journals including Thomson Reuters and conferences including IEEE and it's also available online. Her main research work focuses on Software Engineering, Network Security, Data Structure, Big Data Analytics, Data Mining, IoT and Wireless Sensor Network . She has 8 years of teaching experience and 2 years of Research Experience.

Dr Parma Nand is Dean, Computing Science & Engineering, Sharda University, Greater Noida. He has over 24 years of teaching and research experience. He has expertise in Wireless and Sensor Network, Cryptography, Algorithm and Computer Graphics. He has been Ex-President of National Engineers Organization.He is senior member of IEEE (USA). He is member Executive Council of IEEE UP section, member Executive Committee IEEE Computer and Signal Processing Society, member Executive of India council Computer Society, member Executive Council Computer Society of India, Noida section and has acted as an observer in many IEEE conferences. He is also having active memberships of ACM, CSI, ACEEE, ISOC, IAENG, and IASCIT. He is life time member of Soft Computing Research Society (SCRS) and ISTE. He has published more than 60 papers in peer reviewed international/national journals and conferences. He is an active member of advisory/technical program committee of reputed International/National conferences & reviewer of number of reputed Journals e.g. Springer, Elsevier Journal Computers & Electrical Engineering.

Presently Principal & Professor, *Maharishi Markandeshwar* Engineering college,Mullana,Ambala (Haryana) Constituent institution of *Maharishi Markandeshwar University*, Mullana is **NAAC accredited 'A' grade deemed university** & the first private engineering college of Haryana established in 1995. Also Dean Faculty of Engineering and Technology & Member of Board of Studies & DRC Committee for Research.**Ex-Principal & Professor, Rajasthan College of Engineering for Women (Leading Women's Engineering College in the state of Rajasthan).** Publications: International Journals: Published: 45 (Accepted: 61);International Conferences: Published: 90 (Accepted: 102)National Conferences & Workshops: 75 (Accepted: 110 & more)Text Books/**EDITED**: 06.
Total Experience: 20 years (10 years PG) + 03 years Research International Conferences Organized:10. He is an active member of advisory/technical program committee of reputed International/National conferences & reviewer of number of reputed Journals e.g. Springer, Elsevier Journal Computers & Electrical Engineering. Approximate 20 years of rich experience in Teaching, research and industry managing technical institution, serving in all capacity including Head of Department, Professor, Controller of Examination, Dean Academics Affairs, Principal etc. Played leading role in accreditation of the institution and ISO 9001:2000 certification. (including05 years of industrial/research experience)

Ms. Rani Astya is working as Asst Professor in Sharda University, Gr. noida. She pursued her graduation (B.E.) in computer science Engg from Jiwaji University(Gwalior, MP) and post graduation(M.Tech) in Information Technology from IIT Roorkee. She is pursuing Ph.D. from Banasthali Vidyapeeth, Rajasthan.She has 22 years of teaching and research experience Her research domains are OPTIMAL PATH PLANNING FOR MOBILE ROBOTS by Quadtree method. She has published more than 20 research papers in reputed international journals and conferences.