

Incorporation of Non-Fictional Applications in Wireless Sensor Networks

Ankur Sisodia, Swati, Hina Hashmi

Abstract: At present, various studies regarding the Wireless Sensor Network have already published in various fields and applications but there is always a further scope and also challenges comes under the way of researchers and they have to overcome them. Wireless Sensor Network always has some potential in the field of research and we have to go through them and try to study or analyse them. In this paper, we try to study some non-fictional applications so that we can analyse in future how these applications work with wireless sensor networks for this we concisely define Wireless Sensor Network to sum things up and mainly focus on the study of non-fictional applications like: Patient information in Hospital, Tracking: searching and determining location, Context Aware and Retailing: sales and service support. It is important to know about these applications of Wireless Sensor Network so that they can be used in efficient manner by both user and developer.

Keywords: Wireless Sensor Network, Patient information, Tracking, Context Aware and Retailing.

I. INTRODUCTION

As we probably are aware there are parcel of exploration is now done on Wireless Sensor Network so it isn't worth to talk about over and over same things. Consequently, in this paper we for the most part center around the reasonable uses of Wireless Sensor Network and give a concise history of Wireless Sensor Network. A sensor arrange is made out of loads of sensor hubs, which are thickly sent for observing in territory area. These sensors hubs can convey to one another or straightforwardly to the focal base-station. These enormous quantities of sensors hubs permits covering huge geographic zone through detecting with more noteworthy precision. Every sensor hub includes detecting, preparing, transmission and force units. These sensor hubs are generally positioned in a sensor field, where sensor field is a zone where the distinctive sensor hubs are conveyed to more readily see how they interface with one another and furthermore associates with the product's of the framework, and attempt to sift through what to be requirement for additional improvement in a methodically way [1]. Remote sensor organize contains enormous number of sensor hubs furnished with detecting, registering, handling, transmission and correspondence capacities. Each sensor hub can detect the components of nature to perform basic calculations and have capacity to speak with one another or straightforwardly to the base station [2].

Revised Manuscript Received on September 05, 2020.

Mr. Ankur Sisodia, Assistant Professor, Department of Engineering & Computing Sciences, Teerthanker Mahaveer University, Moradabad, Uttar Pradesh, India. E-mail: ankur22887@gmail.com

Mrs. Swati, Assistant Professor, Department of Engineering & Computing Sciences, Teerthanker Mahaveer University, Moradabad, Uttar Pradesh, India. E-mail: swativishnoi1@gmail.com

Mrs. Hina Hashmi, Assistant Professor, Department of Engineering & Computing Sciences, Teerthanker Mahaveer University, Moradabad, Uttar Pradesh, India. E-mail: hinahashmi17@gmail.com

A Wireless Sensor Networks (WSN) is a great deal of hundreds or thousands of little scope sensor center points that have capacities of identifying, developing distant correspondence between each other and doing computational and getting ready errands [3]. A wireless sensor network is composed of large number of individual sensor "nodes", sometimes called as "motes", each have their own individual abilities like power, computation, sensing the environment, and hardware for wireless communication. The sensors are often placed or scattered randomly around a geographically diverse terrain and then these motes will be activated and starts to form a communication networks so that they can easily transmit a complete "picture" of the environment back to the external central location for analysis [4].

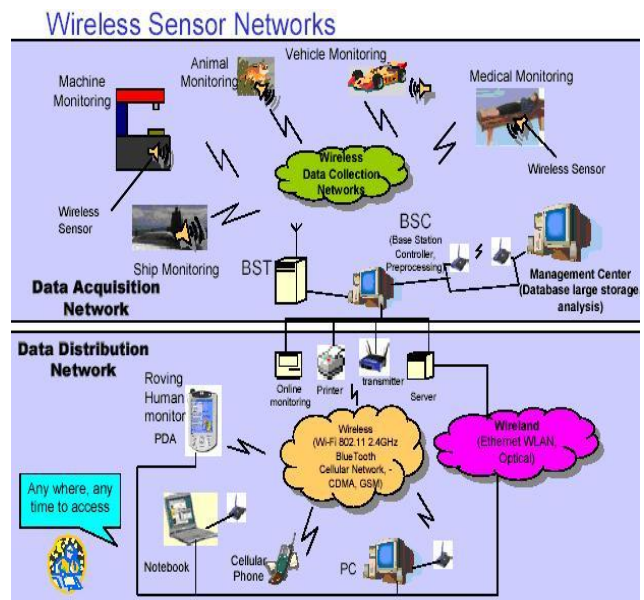


Fig: 1 Wireless sensor network [5]

II. PATIENT INFORMATION IN HOSPITAL

Hospitals are one of the stressful places of our daily life but it is our need to visit the hospital for routine check-ups, in case of emergency and when we are suffering from illness etc. Medical clinic visits are unpleasant encounters for patients and their friends and family [6]. We visit hospital to overcome our problem from which we are suffering but the procedure of formalities creates dilemma of problems in front of the patient due to this he is unable to overcome his problem but he will suffer with new problem 'stress' because of this stress, high anxiety level and incomplete information he is unable to properly follow the instructions which is written in the brochure and over the walls of hospitals.

These incomplete communications not only affects the patients but also effect the reputation of hospitals, so we need something that not only beneficial to patients so that they can easily understand the procedures and also which are beneficial to the growth of hospital both: popularity and economic. The solution of this problem is Wireless Sensor Networks, now the question arises “How Wireless Sensor Networkovercomes these problems?” here we providing the answer of this question in three ways:Monitoring of Patients Data, ERP management of drugs in Hospitals[7].

A. Tele-monitoring of Physical Data

The Physical Data about the treatment, medicines, information of doctors etc. is so much that it is hard to handle therefore patient need something that can helpful him in collecting this data at one place, it can be done through Tablet Computer and Mobile.

B. Tablet Computer Application for Patient [8]

In a hospital there is a very less communication between the patient and the physician because of the less time, changing shift of the physicians due to this reason patient is not able to aware about the treatment through which he is going on, proper information about the medicines and even the difficulty in remembering the name of the physician last attended all these reasons will create more insecurity and rises his anxiety level. It can be overcome if we provide a Tablet Computer to the patient in which he have all the proper information regarding the treatment, medicines, physicians etc, it will help him lot. As shown in the figure 2 and 3: a screen shot in which there is a whole history of patient: name, the disease which he is suffering, the tests through which he undergoes, list of medicines, the physicians who attended him and the list of precautions he have to taken in during the treatment and in the future. This Tablet Computer Application will give satisfaction to both patient and physician: as patient he can easily remember all the things like treatment, medicines etc and as physician it will help him to manage the database of his entire patients at one place and easily enquire them, due to this whole history of every patients because of the tablets with the help of sensors it can easily manage the data for longer period and also explore the symptoms of patients in future visit.

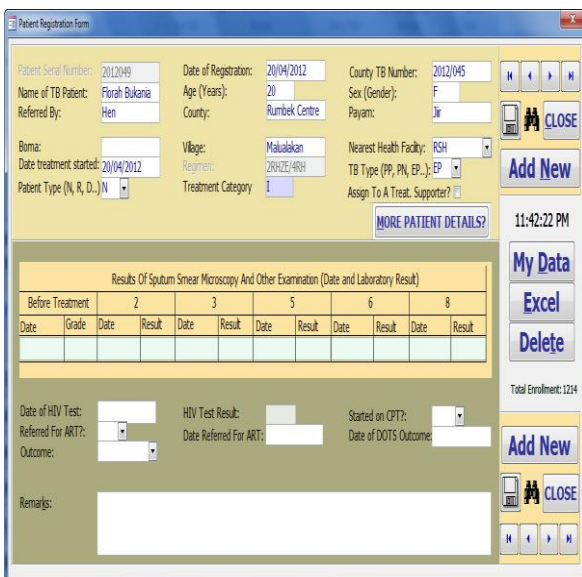


Fig 2: Patient View [9]

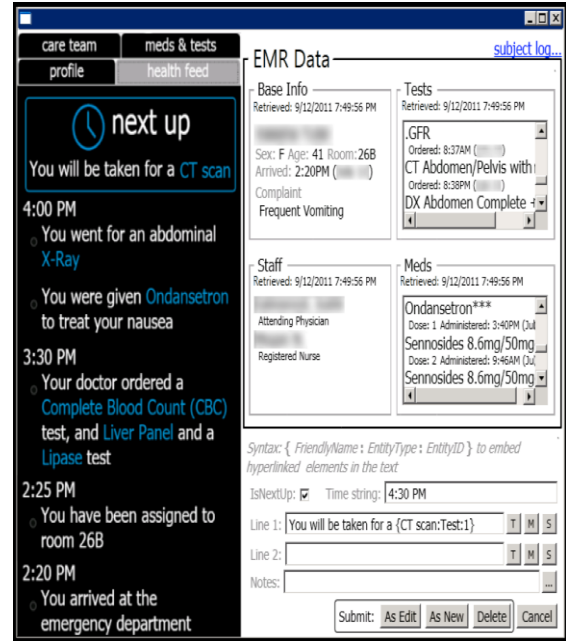


Fig3: Information of Patient Treatment [10]

C. Mobile Phones

The most basic electronic device which is frequently used now days is mobile phones; it also can be used to give information about his treatment in an efficient manner. As we can see from figure 4,5,6,7 gives all the information from the starting of hospital visit to the treatment [10]. Mobile Phone can be more powerful application because now a day’s general people knows how to use mobile phone in efficient manner and may be it also give better result than tablet computer. There are several advantages in providing information on the mobile phones in comparison to the other form of factors. As we know that in the emergency department the process of caring to the patient is dynamic; according to the situation the course of treatment is changing rapidly and also its information.

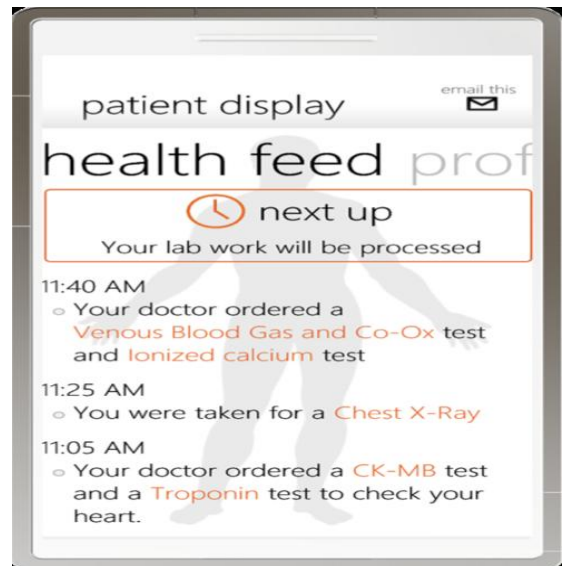


Fig 4 : The Health Feed provides a real-time list of pending and completed care events.



Fig 5 : The Profile page provides general information about the patient's visit.



Fig 6 : The Care Team page provides a record of relevant staff.

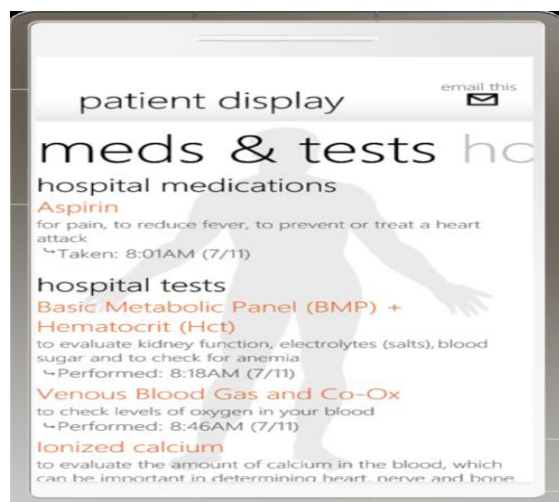


Fig 7: The Meds & Tests page provides a list of medications and tests administered during the patient's stay [10].

With the help of mobile phone patient can easily access the present and past information easily. Additionally, as we know that in the emergency department the location of patient is changes inherently it can be in test lab, in their room, mid-way etc. A mobile provides information to patient's according to their present location.

From the above discussions we can conclude that Wireless Sensor Network with these applications can be helpful for patients in hospital during his whole treatment from medication to discharge and also in decreasing his stress level.

D. Tracking and Monitoring Doctors and Patients in a Hospital

Tracking and monitoring both doctor and patient is one of the important part of hospital facilities, it gives confidence to the patient he is in surveillance for whole 24 hours and also we can track any doctor in emergency if he present in hospital. It can be done in the following ways:

E. BluetoothScatternet [11]

In this they form a scatter net with the help of piconets and these piconets can connect with one or more Bluetooth device so that can easily track down the patients and doctors. The patients are at 24x7 basic consideration. In this they set a few remedial sensors to the each patient hub. The remedial sensors are utilized to detect and to gauge the different wellbeing boundaries which have a place with the patient, with the help of these sensors we diagnose the patient's stress and its physiological data and take actions according to them. This data is collected from the each patient and then transmitted to the local nurse. Subsequent to getting the current status of the patient she will dissect the circumstance and attempt to give conceivable treatment and if the circumstance is crazy the she will additionally contact to boss attendant. Boss Nurse likewise follows a similar system and on the off chance that crazy, at that point contact to either boss specialist or collaborator specialist relying on their accessibility. At long last the specialist will deal with persistent in required way.

F. Smart phones

Smart phones also can be used to track down the positions of doctors and patients through wireless sensor network. Utilizing SNETs [12], enormous scope impromptu sensor systems (ASNET) can be conveyed among versatile patients, along these lines, this system can be utilized to give data or screen the patients by the specialists or any clinical authority at wherever with the assistance of web or cell arrange. If there should arise an occurrence of a crisis, specialists and medical caretakers can be effectively reached through advanced mobile phones.

G. Drug Administration in Hospitals

Administration of drugs according to the need of patient and hospital is very important because whole functioning and profit is depending on drugs:

H. Patient

From patients we means that if we are able to attach sensor node on the patients as wrist watch sensor node as the doctor enter the prescription in the computer system for patient then it encompasses all the systems that utilizations standardized tags on tolerant wrist groups and cautions of medication connections and other expected issues, because the patients have sensor nodes that identify their allergies and required medications.

As the report by Barbara Sibbald, CMAJ says that entering solutions into a PC as opposed to keeping in touch with them out can forestall up to 84% of measurements blunders and can help in limiting antagonistic medication occasions [13].

I. Hospital

From hospital we means that if we make a counter outside the door of the medical store with sensor node which is in the hospital then it will keep track on all the medicines with help of its bar code, it will help in the management of medicines for the hospital by protecting them from out of stock, theft etc. because of this it will maintain the profit of the hospital.

J. Sensors

From the early researches we study that we can implant different sensors on the patient for different causes like for monitoring heart rate, monitoring blood pressure etc. if there any emergency occurred these sensor will inform the hospital staff and also the sensor can be attached to both doctors and patients as wrist watch sensors from these we can easily track down both doctors and patients.

III. TRACKING: SEARCHING AND DETERMINING LOCATION

Tracking by reading this words in terms wireless sensor network first thing comes in to mind is 'military surveillance' but the scope of tracking is not restricted to only military surveillance its scope is far beyond, it can be used for environmental monitoring and emergency services, habitat monitoring and agriculture monitoring. Now we discuss all these aspects separately in brief to clear the things more.

A. Military Surveillance

Wireless Sensor Networks are most suitable because of its small nodes which can be easily deployed and used for various purposes like determining location of mines, location of enemy and for targeting missiles etc.

Military Applications:

- Monitoring Friendly Forces, Equipments and Ammunition [14]
- Battlefield Surveillance [14]
- Targeting [14]
- Battle Damage Assessment Nuclear, Biological and Chemical Attack Detection. [14]

College of Virginia present a situation in which they suggested that mines might be supplanted by a huge number of scattered bits and that will be valuable in the identification of an obstruction of any unfriendly units and it additionally be ruinous for them [15]. Ohio State University additionally introduced a use of this sort and they named it this task "A line in the Sand" and in which they send ninety hubs and they are equipped for recognizing metallic articles. Vigil Net [17] is a military wireless sensor network that is used to acquire and verify the positions of enemy targets and also gives information about its capabilities. It has been already successfully built and tested and also delivered to the Indian Intelligence Agency for its deployment. From the above researches we stated how wireless sensor network is used for military applications.

B. Environmental Monitoring and Emergency Services

One of the important application of wireless sensor network is environmental monitoring in which with the help of different sensor network we sense the different environmental parameters like temperature, humidity, rains, droughts and earthquakes etc. and try apply Emergency Services in advance so that the effects of these environmental attacks can be reduced and overcome in possible way. As in the last years there are lot of tsunami attacks near the coastal areas therefore as per the precautions government passes the order to clear these areas in advance so that they can easily overcome the losses and also cause less effect to the human beings. Environmental can be indoor [18], the capacity of distinguishing temperature, light, status of edges (windows, gateways), air streams and indoor air defilement can be utilized for perfect control of the indoor condition. As we realize that, pointless warming or cooling of structures causes heaps of wastage of vitality. Sensor hubs or bits can help in utilizing electronic types of gear like radiators; fans and so forth in a proficient path by forestalling wastage of vitality and furthermore gives loads of solace to the occupants of that building. From above we determine how the wireless sensor network can help to overcome both outdoor and indoor environmental problems.

C. Habitat Monitoring

Wireless Sensor Network also can be used for monitoring the habitats so that we can calculate how much habitats are left and can do possible measures so that they don't get extinct. In this field using wireless sensor network various researches has been done in past like The Great Duck Island [19] in which wireless sensor network is established in the park so that can monitor the birds and its surrounding environment and try to fix this environment according to the need of birds. The University of Hawaii focuses his research in Volcano National Park [20], in this research they try to discover why some species able to survive in some specific regions due to this research we can evaluate the reasons why species get extinct. The North Carolina State University conduct a study on

Red Wolves [21], these species are also endangered species. In this research they attached the both dynamic and static nodes to the red wolves so that they can understand its climatic conditions. From above research's we can prove that wireless sensor network also used for habitat monitoring.

D. Agriculture Monitoring

Wireless Sensor Network is also used for Agriculture Monitoring in which we sense the different parameters like temperature, rain, water flow, soil etc. which is important for irrigation. It can help various ways to the farmers and give efficient results. However various researches already done in the past to prove this fact like Wireless Sensor Network in Precision agriculture [22], in this we

- First we sense all the required agricultural parameters.
- Second identify different locations for sensing and gather required data.

- Third Transfer gathered data from crop field to base station so that we make required decision.
- Fourth proper control and constrained decisions are making based on the sensed data.

Intel Research Berkeley Labs cooperation with Intel corporation apply sensor network in a vineyard to study about the microclimates so that it improve the productivity and helpful to farmers [23].

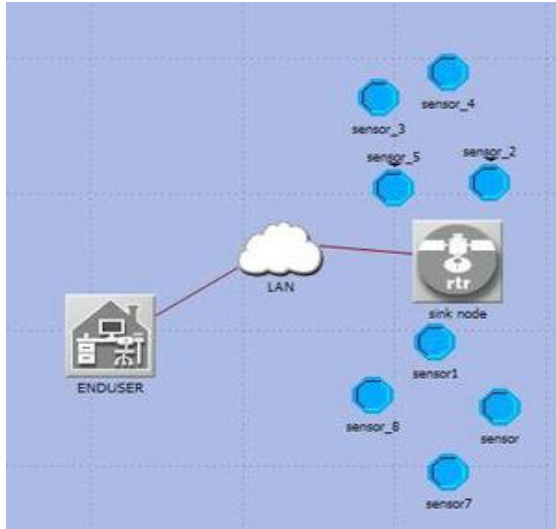


Fig 8: Wireless Sensor Network for Agriculture [22]

K. Yunseop, R. G. Evans, and W. M. Iverse utilized a shut circle water system framework and decided water system sum dependent on dispersed soil water estimations [24]. G.H. E. L. de Lima, L. C. e Silva, P.F. R. Neto utilized radio transmission for estimating the information with respect to soil dampness and move that information from information lumberjacks to a focal PC logging site [25]. Y. Xijun, L. Limei, X. Lizhon explored the designs of wireless sensors for measuring soil moisture and to implement plug-and-play technology for water sprinkler valves and also proposed architectures of distributed sensor networks for the automation of irrigation system. From these works we can say that wireless sensor network can be beneficial in the field of agriculture and in future also.

IV. CONTEXT AWARE

For understanding the word “Context Awareness” first we have to understand what “Context” stands for?. From the last researches we can conclude that Context is the set of information’s under which we determine or characterise the behaviour of application, person or anything, set of information can be environmental (like temperature, season, time etc) and physical (like location, axis etc). From this definition of Context we can define Context Aware as the ability of application, device or system to adapt these contexts and provide the information according to it’s which user wants. From the above aspects any one can interpret that Context Aware is basically used for location determination but it can also be used as context aware as mobile computing [27], context aware as middleware [28] and context aware as homes [29].

A. Context Aware as Mobile Computing

As the sizes of computing devices decreasing day by day from large frame computers to personal computers, personal computers to laptops, laptops to tablets and now tablets to

goggle glass, so it is interesting to see how mobile uses context aware in its computing. It can be used as:

B. Call Forwarding [30]

Call forwarding is the most basic application of mobile in which a user can assign another mobile number in his mobile application and the call will transfer to that number if he is unable to take the call and this is also helpful in offices where receptionist sitting on one place transferring the calls in whole office for both it uses location context for . It can be used as:

C. Call Forwarding [30]

Call forwarding dynamic URLs means it permits client to reference dynamic logical data in hypertext connect which may contain condition factors, it extends our standard browser. Mobiasic also supports active documents which means as the value of environment variable changes the web page gets updated. It uses both location and time context.

D. Shopping Assistant [32]

Mobile also can be used as a shopping assistant in which mobile application tells the position of every product where it is placed in store for this it also uses location context but with respect to each other for the accuracy of position.

E. Cyber Guide [33]

Mobile also used as a Cyber Guide in which mobile will tell the tourist about the various locations of hotspots to visit, also the restaurants, hotels and shopping malls, for this it uses Global Positioning System (GPS). It uses both location and time context with respect to the position of tourist.

F. Tracker [35]

Mobile also used as a tracker for determining the position of user and also when the mobile is lost or stolen, it also uses GPS. It uses both location and time context with respect to the mobile.

G. Context Aware as Middleware

To properly understand this first we have to study middleware, “The basic task of middleware in terms of wireless sensor network is to support the deployment of the sensor nodes according to the applications in which the middleware abstract the data from all the sensor nodes, collects them and sends to the user’s application in understandable form”. Now we can conclude that Context Aware can act as middle ware whose basic task is to abstract the data from the environment and send to the user’s application of PDA’s, Laptops, smart phones etc or we can say context aware computing devices. The basic properties must exist for acting context awareness as middleware context management, adaptation, communication, persistence [28]:

H. Context Management

This property is basically stands how we retrieve and process the information which we are getting from context provider, mobile resources, applications etc. After processing it is the task of middleware to distribute this information according to the requirements.



I. Adaptation

In this property middleware must be flexible so that it can easily adapt the changes occurring and adaptation must be fast it changed as it triggered. From the changes we mean that it can be environmental, structural and behavioural etc.

J. Communication

The platform of middleware must communication supportable means it support different kinds of protocols, interaction paradigms, and communication technologies so that it can easily communicate when changes occurred.

K. Persistence

It also has some storage so that it can store the last values so that it can help during movement and disconnection.

L. Context Aware as Homes

Context Aware as homes are the most unstructured context because it depends on the mood swings of the people living in the home, it is not structured as in offices because in the offices every works has to be done in the formal way, from this we can conclude that it is hard to apply but now it is the today's need that homes should be supported from context awareness because of these scenarios we try to explain this:

M. Security

For the security of home and the people living in the home context awareness is important because we need that wherever and whenever the emergency (like fire, theft, illness etc.) occurred the remedies have to be taken instantly.

N. Privacy

Privacy must be maintained for the people living in the house. By privacy we means that call will be transferred from the phone without disturbing the others, there is no disturbance of sounds to the others etc.

O. Friendly

Make the environment so friendly that as anybody enters in the room all the lights, music, fans goes on and also if anybody working then the environment of room also changes according to that like lights, music, picture frames etc.

P. Children and Elder People

Making the environment according to the children's by converting the normal bedroom in to a room that children imagine in their fantasies it can be done by changing the images, music and creating effects: light, sounds etc [36] and Older individuals can be upheld in their day by day schedule works by making setting mindful homes, by permitting them to live in their own necessary natural condition [37].

Setting mindful correspondence frameworks in house give office to the relatives to address each other possibly they are in a similar room or likewise when they are in various rooms [38].

V. RETAILING: SALES AND SERVICE SUPPORT

Retail industry is one of the biggest industry in which there is always a high pressure for profit. The pressure is not only limited to the owner, it passes in chain from owner to the store manager to store keeper etc. even to the customer who is visiting to the store because he also wants to make profit

in the products which he wants to purchase. The retail business is one that lives and passes on edges, with directors on a ceaseless journey to expand income and abatement costs [39]. For this we need a proper management in store which can be provided by wireless sensor network, it can be beneficial to both owner and customer as it provides better management in store and full service support to the customer. This can be defined as:

A. Sales

From sales we meant about the elements which are needed for managing the sales of store, now we describe how these elements can be beneficially managed through wireless networks.

B. Inventory

The important part of store or we can say 'heart' of store is inventory because it records how much products are sold and left in the warehouse, to manage this we need proper attention it can be done through wireless sensor networks. If we place a wireless sensor enabled counter on the door of the ware house that automatically senses the products by reading its barcode at the time of leaving from warehouse and maintained it in to its database then it is easy to calculate that how much products are left in the store of particular quality, then it is possible that our stock is never goes out of stock because at the time of last product it gives information to the store manager that you have to place an order for that particular product. It not only helps for the ware house it also helpful to calculate the products on the floors.

C. Tracking of products

Wireless sensor networks are helpful in tracking the product from logging to the sale because nodes are able to sense the product from its barcode due to this it give full information to the store manager at which time that product is logged in to the store, at which shelf it is placed and even the which customer have purchase that product. Therefore, there is no stolen of the product.

D. Auditing the price

The auditing the price of product is more tedious because the fluctuation in the price of product is so rigorous that it requires more man power for overcoming this we require some thing it can be sensor network. If we know the exact position of product even in the floor or warehouse we can easily track down the product through sensors and change the price of the product easily. It can be easily done in less time and less man power which is beneficial to the store.

E. Security

Wireless sensor network provide security to the store in various manners like it can senses the fire through the sensor nodes and inform the manager about the accurate region, also senses the appropriate temperature conditions for store and store products.

F. Service Support

From service support we means that the wireless sensor network provide services to the customers, so that the shopping experience will be good for them.



G. Tele-monitor the store data

Through his smart phone customer can easily monitor the whole store products by standing at one place and only go for that place which is requiring for him.

H. Tracking the product

Customer also tracks down all the products which he had purchase whether they properly packed or not.

I. Security

Wireless sensor network also provide the security to the customer if there anything wrong happens to him store manager can easily detect through context awareness with respect to the customer and store.

VI. CONCLUSIONS AND SUMMARY

Until now from the other research works and our research work we can conclude that the wireless sensor network can be used in a vast area of applications but it depends on the ability of the researcher to use the sensor network in a well efficient manner. The various properties of wireless sensor motes or nodes (like high speed, flexibility, rapid and easy deployment etc.) allows the researchers to use sensor network in an available efficient way. From the above we can summarise that wireless sensor network are helpful in reducing the anxiety level of patients also allow the patients to use the facilities of hospital in an efficient way and sensor network also helpful to the doctors and hospital staff. In the field of tracking wireless sensor network scope is not only limited to the military surveillance but it also helpful in various fields like habitat monitoring, environmental monitoring and agricultural monitoring. By using context aware with wireless sensor network helps the developer to extend the ability of its products, providing various facilities to the user due to this it is helpful in fulfilling all the requirements and demands of the user in a good manner. Wireless sensor networks also helpful in the field of retailing. It provides various tools to the owner of store to enhance the capabilities of his store and also allow him to keep all the situations under control and to the user it provides various facilities so that they can enjoy his shopping.

REFERENCES

1. Anubha Barak, PreetiGulia "Data Compression in Wireless Sensor Network" IJCSMS International Journal of Computer Science & Management Studies, Special Issue of Vol. 12, June 2012.
2. Deepti Gupta and Ajay K Sharma "On Performance Evaluation of WSN Routing Protocols for MICA and MICAz using Different Radio Models" International Journal of Energy, Information and Communications Vol. 2, Issue 4, November, 2011.
3. LaialiAlmazaydeh, Eman Abdelfattah, Manal Al- Bzoor, and Amer Al- Rahayfeh "Performance Evaluations of Routing Protocol in Wireless Sensor Network" International Journal of Computer Science and Information Technology, Volume 2, Number 2, April 2010.
4. Shilpi Agarwal, Professor Rajeshwar Lal Dua, Ravi Gupta" Performance evaluation of parameters Using DSR Routing Protocol in WSNs", International Journal of Advanced Research in Computer Science and Software Engineering Volume 2, Issue 8, August 2012.
5. F.L. Lewis, "wireless sensor network," Technologies Protocols and Applications, New York, 2004.
6. Byrne, G., Heyman, R. Patient anxiety in the accident and emergency department. J Clin Nursing, 6:4 (1997).
7. I.F. Akyildiz, W. Su*, Y. Sankarasubramaniam, E. Cayirci Computer Networks 38 (2002) 393-422.
8. David K. Vawdrey, PhD , Lauren G. Wilcox, MS, Sarah A. Collins RN, PhD, Suzanne Bakken, RN, DNSc, Steve Feiner, PhD, Aurelia

9. Boyer, RN, MBA, Susan W. Restaino, MD" A Tablet Computer Application for Patients to Participate in Their Hospital Care".
<http://www.newtdrugs.org/blog/wp-content/uploads/2012/06/The-Electronic-TB-Register-Patient-Registration-Form.jpg>
10. Laura Pfeifer Vardoulakis, Amy K. Karlson, Dan Morris, Greg Smith, Justin Gatewood, Desney S. Tan "Using Mobile Phones to Present Medical Information to Hospital Patients".
11. Sivaranjani, Vignesh Kumar, Sathya, Santhi "Automatic Patient Monitoring System Using Scatternet for Critical Care", Journal of Theoretical and Applied Information Technology, June 2012 ISSN: 1992-8645.
12. Tarek R Sheltami, Ashraf S Mahmoud and Marwan H Abu-Amara "Warning and monitoring medical system using sensor networks", 18th National Computer Conference 2006.
13. Barbara Sibbald, CMAJ "Use computerized systems to cut adverse drug events: report", at Dalhousie University Aug. 11-12.
14. G. Padmavathi, D. Shanmugapriya, M. Kalaivani "A Study on Vehicle Detection and Tracking Using Wireless Sensor Networks"doi:10.4236/wsn.2010.22023 published Online February 2010 (www.SciRP.org/journal/wsn/).
15. T. He, S. Krishnamurthy, J. A. Stankovic, T. Abdelzaher, L. Luo, R. Stoleru, T. Yan, L. Gu, J. Hui, B. Krogh, "An energy-efficient surveillance system using wireless sensor networks", MobiSys'04, Boston, MA, 2004.
16. He, T., Krishnamurthy, S., Yan, L.L.T., Gu, L., Stoleru, R., Zhou, G., Cao, Q., Vicaire, P.,Stankovic, J., Abdelzaher, T., Hui, J., Krogh, B.: Vigilnet: An integrated sensor network system for energy efficient surveillance. ACM Transactions on Sensor Networks 2(1), 1-38 (2006).
17. <http://www.coe.berkeley.edu/labnotes/0701brainybuildings.html>
18. Mainwaring, J. Polastre, R. Szewczyk, D. Culler, and J. Anderson, "Wireless sensor networks for habitat monitoring", In ACM Inter. Workshop on Wireless Sensor Networks and Applications (WSNA'02), Atlanta, GA, 2002.
19. Biagioni, K. Bridges, "The application of remote sensor technology to assist the recovery of rare and endangered species", In Sp. iss. on Distributed Sensor Networks for the Int. Journ. of High Performance Computing Applications, Vol. 16, N. 3, 2002.
20. http://www.ncsu.edu/news/press_releases/03_11/321.html.
21. ManijehKeshtgary, AmeneDeljoo, "An Efficient Wireless Sensor Network for Precision Agriculture" Canadian Journal on Multimedia and Wireless Networks, Vol. 3, No. 1, January 2012.
22. Burrell, T. Brooke, R. Beckwith, "Vineyard computing: sensor networks in agricultural production" Pervasive Computing, IEEE, Volume: 3, Issue: 1, pp. 38-45, Jan.-Mar 2004.
23. Yunseop, R. G. Evans, and W. M. Iversen, "Remote Sensing and Control of an Irrigation System Using a Distributed Wireless Sensor Network," Proc. Of IEEE Transaction On Instrumentation AND Measurement, USA, vol. 57, no. 7, pp. 1379 - 1387, July 2008.
24. G.H. E. L. de Lima, L. C. e Silva, P.F. R. Neto, " WSN as a Tool for Supporting Agriculture in the Precision Irrigation," sixth International conference of Networking and Services (ICNS), 2010, pp. 137 - 142.
25. Guanling Chen, David Kotz, "A Survey of Context-Aware Mobile Computing Research" Dartmouth Computer Science Technical Report TR2000-381.
26. Daniel Romero "Context-Aware Middleware: An overview" Author manuscript, published in "Paradigma 2, 3 (2008) 1-11" may 2010.
27. Sven Meyer, AndryRakotonirainy, "A Survey of Research on Context-Aware Homes".
28. Roy Want, Andy Hopper, Veronica Falcão, and Jonathan Gibbons. The Active Badge location system. ACM Transactions on Information Systems, 10(1):91-102, January 1992.
29. Geoffrey M. Voelker and Brian N. Bershad. Mobisaic: An information system for a mobile wireless computing environment. In Proceedings of IEEE Workshop on Mobile Computing Systems and Applications, pages 185-190, Santa Cruz, California, December 1994. IEEE Computer Society Press.
30. Abhaya Asthana, Mark Cravatts, and Paul Krzyzanowski. An indoor wireless system for personalized shopping assistance. In Proceedings of IEEE Workshop on Mobile Computing Systems and Applications, pages 69-74, Santa Cruz, California, December 1994. IEEE Computer Society Press.
31. Gregory D. Abowd, Christopher G. Atkeson, Jason Hong, Sue Long, Rob Kooper, and Mike Pinkerton. Cyberguide:

- A mobile context-aware tour guide. *Wireless Networks*, 3(5):421-433, October 1997.
32. Brian Brewington and George Cybenko. Keeping up with the changing Web. *IEEE Computer*, 33(5):52-58, May 2000.
 33. Bobick, A.F., et al. (1999): The Kids Room: a perceptually- based interactive and immersive story environment. *Presence* 8(4):369-93.
 34. Mynatt, E.D., Essa, I. and Rogers (2000): Increasing the opportunities for Aging in Place. In Conference on Universal Usability. CUU 2000. ACM, New York, NY, USA; 2000; xiii+165 pp. 65-71. SCHOLTZ, J. and THOMAS, J. (eds).
 35. Nagel, K.Kidd, O'Connel, Dey, A.K. and Abowd (2001): The Family Intercom: Developing a Context-Aware Audio Communication System. Proc. Ubicomp 2001, Atlanta, Georgia, LNCS 2201:176-183, ABOWD, D., BRUMITT, B. and SHAFER, S. (eds). Springer-Verlag.
 36. Aruba Network's White Paper, "Technology Advances in Retail: Improving Margins using Wireless Networks" 2012.

AUTHORS PROFILE



Mr. Ankur Sisodia working as Assistant Professor in Faculty of Engineering & Computing Sciences at Teerthanker Mahaveer University, Moradabad, Uttar Pradesh, India. He received M.Tech in Computer Science & Engineering from Dr. A.P.J Abdul Kalam University, Lucknow, India and B.Tech from Uttrakhand Technical University, Dehradun. He has published one Patent with the Intellectual Property

Division of the Government of India. He has 4 years of teaching experience in TMU, Moradabad and Shri Siddhi Vinayak Group of Institutions, Bareilly, Uttar Pradesh where he taught various subjects like: Data Base Management System, Operating System, Programming in C, Data Communication and Networks, Digital and Cyber Forensics, Data Structure using C, Design Analysis & Algorithms, Ethical Hacking. His research area is Wireless Sensor Network and he also working toward his Ph.D. degree where his research area may be VANET. Address: Lions Colony, Near Lions School, Gali Number-2, Chandausi, 244412 Email-id: ankur22887@gmail.com Mobile Number: 9411432881



Mrs. Swati, working as Assistant Professor in Faculty of Engineering & Computing Sciences at Teerthanker Mahaveer University, Moradabad, Uttar Pradesh, India. She is pursuing her Ph.D. in Computer Science & Engineering from Uttrakhand Technical University, Dehradun, Uttrakhand, India, MCA from Gautam Buddh Technical University, Lucknow, Uttar Pradesh, India. She is also UGC-NET qualified in 2018. She

has published one Patent with the Intellectual Property Division of the Government of India .She brings to her classes, over 8 years of teaching experience. She taught various subjects like: Java Programming, Advance Java, C# Programming Language, VB.Net, Programming in C, Data Structure using C, Design Analysis & Algorithms. She got one best research paper award in SMART conference. Her research area is Image Classification in Remote Sensing. Address: B-78, Prem Nagar, Lane No-1, Line par, Moradabad, 244001 Email-id: swativishnoi1@gmail.com Mobile Number: 9412552978



Mrs. Hina Hashmi , working as Assistant Professor at Faculty of Engineering & Computing Sciences, Teerthanker Mahaveer University, Moradabad, Uttar Pradesh, India. She is pursuing her Ph.D. in Computer Applications from Teerthanker Mahaveer University, Moradabad, UP, India; she has completed her Masters in Computer Applications from Teerthanker Mahaveer

University, Moradabad, Uttar Pradesh, India in 2012. She qualified UGC-NET in Dec 2019. She is having near about 7 years of teaching experience. She taught various subjects like C# Programming Language, Visual Basic.Net, Programming in C , C++, Data Structure using C, Design & Analysis of Algorithms, Operating system as well as some Animation subjects like CorelDraw , Photo Shop, Flash. She honored with a Gold Medal in her Post Graduation. Her research area is "Study of Convolutional Neural Network and its modified versions for Object Detection from Remote Sensing Data. Address: 147, Behind Police Station Nagphani, Nawabpura Road, Moradabad, 244001 Email-id: hinahashmi17@gmail.com Mobile Number: 7417240458