Scientific Journal Impact Factor (SJIF) : 1.711
International Journal of Modern Trends in Engineering and Research
ISSN (ONLINE) : 2349 - 9745
ISSN (PRINT) : 2393 - 8161

A Survey: Wireless Sensor Networks for Personal Health and Structural Health Monitoring

S.B. Jadhav[1], L.P. Bhamare[2]

[1,2] Electronics and Telecommunication Department, SVIT Chincholi

Abstract—A wireless Sensor Network system is having potential to monitor the Human Health, Structural health monitoring for building, bridges. In this paper a survey on Human health monitoring & Structural health monitoring is shown by using wireless sensors network. Different applications by wireless sensors for healthcare system is discussed. Technical challenges regarding health care system is explained. Application of ubiquitous for structural monitoring also explained. The advantages & applications of wireless Sensor Network system also discussed. This paper is purely a survey of earlier work of different Authors.

Keywords- Wireless Sensor Networks, Ambient Health Monitoring, Structural Health Monitoring, Personal Health Monitoring, Technical Challenges

I. INTRODUCTION

Embedded system is become a pervasive part of daily life. The heterogeneity of modern embedded system & the varying demand of their target applications greatly complicate the system design. It is widely agreed upon that traditional design method fall short for the design of these systems as such method s cannot deal with the system complexity & flexibility. A wireless sensor Network for Composed of a large number of sensor nodes to interact with physical world [1].Low power tiny cheap ,small size sensors are capable of sensing wireless communication[2]. Human Health Monitoring is becoming necessary. Longer lifetimes create challenging demands for elderly people with degrading mental & physical abilities. Ambient Health Monitoring (AHM) can be used proactively as a mean of encouraging healthy life strategies in people [3].The Ambient Assisted Living (AAL) projects focus on specific aspects of service like in Dia-Trace project [4], which combines activity detection, Meal Photographs, blood sugar monitoring system.

Embedded system with wireless monitoring also used for structural monitoring for detection damages in Bridges, ships & aircraft .wireless sensor can address the issues like earthquakes, wind, passing vehicles vibrations. Structural Health Monitoring (SHM) focuses on Developing technologies & systems for assessing the integrity of structures such as buildings, bridges, aerospace structures & off-shore oil rigs. [5] For the old/or damaged structures, incrementing a large scale data acquisition system may not be possible for safety reason. The general purpose of structural monitoring is to produce safety & reliability of the structural system, sustainability & life cycle cost reduction.

In this paper we present the survey of holistic approach for AHM& Challenges of wireless sensor network in health care monitoring system. Also a survey on wireless sensor network system for structural health monitoring system.

II. RELATED WORK

2.1. Ambient Health Monitoring [3]

The AHM system can be well evaluated by Life-logging application. Different users were relevantly considered like vital parameters-when User wants measure & view vital signs for accessing their present health state, in sports athletes can use this application, and people can observe their weight loss and energy balance. Designing technique for AHM system is simple and user friendly. User should able to set goals themselves and monitor their progress. Current measure vital signs should be display the user heath status.

The AHM system is designed considering above goals. The dynamix based android app is developed to provide life-logging features. The app has several interfaces like dynamix plugin can be loaded, activated and used to measure respective values using inbuilt external sensors. Values for fitness factors can be represented by mean deviation user can set goals themselves by indicating the activity. Measured values are displayed in real time view; user can create his smart assist profile that can be used to calculate the standard values based on biometric data.

The life-logging application broadly views the calculation of the fitness factors need to be more transparent. In life-logging application vital signs such as blood sugar can be added with appropriate measuring devices.

2.2.Wireless Sensor Network for Personal Health Care Monitoring System Issues. [6]

Latest advances in sensors, low-power integrated circuits, and wireless communications have enabled the design of low cost, miniature, lightweight, and intelligent physiological sensor nodes. These are capable of sensing, processing, and communicating. These networks promise that provides inexpensive, continuous, ambulatory health monitoring almost with real time medical report updates via the internet. This Wireless Health or Body network provides secure, and power efficient medical applications. This provides the system architecture and hardware and software organization, as well as power management, and on chip signal processing.

Now a days a health care systems are structured, and optimized facing new challenges while growing population of elderly and rising health care spending. By survey of U.S Bureau of Census the adults age 65-84 is expected to double from 35 million to nearly 70 million by 2025, so the worldwide population over age 65 is expected to more than double in 2025. So who is having full time jobs, were serving as informal caregivers for the elderly parents. By this it is projected that health care expenditures will reach almost 20% of the Gross Domestic Products in less than 10 years. So this statistics suggest that the personal health care need a major shift towards more scalable and more affordable solutions. Again the wearable health care monitoring system allows an individual to closely monitor changes in her or his vital signs and provide the optimal health status. In WWBAN each sensor node can be integrated. In that each sensor node can sense the sample and can process the signal.

2.3. List of healthcare applications By Wireless sensor Network. [7]

Monitoring in mass-casualty disasters: While triage protocols for emergency medical services already exist [8] their effectiveness can quickly degrade with increasing number of victims. Moreover, there is a need to improve the assessment of the first responders' health status during such mass-casualty disasters. The increased portability, scalability, and rapidly deployable nature of wireless sensing systems can be used to automatically report the triage levels of numerous victims and continuously track the health status of first responders at the disaster scene more effectively.

Vital sign monitoring in hospitals: Wireless sensing technology helps address various drawbacks associated with wired sensors that are commonly used in hospitals and emergency rooms to monitor patients. The all too familiar jumble of wires attached to a patient is not only

uncomfortable for patients leading to restricted mobility and more anxiety, but is also hard to manage for the staff. Quite common are deliberate disconnections of sensors by tired patients and failures to reattach sensors properly as patients are moved around in a hospital and handed off across different units. Wireless sensing hardware that are less noticeable and have persistent network connectivity to backend medical record systems help reduce the tangles of wires and patient anxiety.

2.4. Technical Challenges

2.4.1. Trustworthiness

Healthcare applications impose strict requirements on end-to-end system reliability and data delivery. For example, pulse oxime try applications, which measure the levels of oxygen in a person's blood, must deliver at least one measurement every 30s. A number of factors complicate the systems' ability to provide the trustworthiness that applications require.

2.4.2. Privacy and Security

Privacy & security is important accept for the paients. More care is required to take on these accept by the wireless sensor system as they directly related to health of patients.

2.4.3. Resource Scarcity

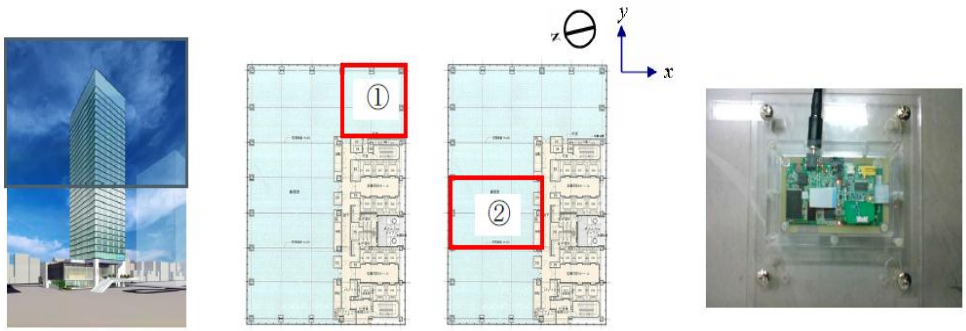
In order to enable small device sizes with reasonable battery lifetimes, typical wireless sensor nodes make use of low-power components with modest resources. The extremely limited computation, communication, and energy resources of wireless sensor nodes lead to a number of challenges for system design.

III. STRUCTURAL HEALTH MONITORING AND WIRELESS SENSOR NETWORK

The structural and basic performance of bridges is dependent on a variable combination of local conditions, use profiles, and design parameters. There are number of bridges in to the world which are deficient or functionally obsolete. Yet, existing inspection-based maintenance procedures do not adequately address the growing sustainment cost and safety concern related to this aging infrastructure. In order for the Nation's bridge network to support long-term use at a feasible cost, future bridge management initiatives will require scalable, high-resolution health monitoring and modelling capabilities [9].

3.1. Ubiquitous structural monitoring (USM) [10]

Ubiquitous structural monitoring (USM) of buildings using wireless sensor networks is one of the most promising emerging technologies for mitigation of seismic hazard. This technology has the potential to change fundamentally the traditional monitoring systems. In this the author shows introduction of wireless sensor network technology for the USM, and reported research activity on development of sensor module. The developed module which primarily consist of sensor board and wireless sensor module which is tested with shaking table, and it is having enough basic performance for the USM. The actual application of Ubiquitous structural monitoring is shown in below figure 1.



(a) General view. (b) Plan on 13th and 6th floor. (c) Installation of sensor node
Fig 1: Applied high-rise building and installation of sensor node

Basically the applied USM system which consist of sink node and sensor node to actual high-rise building for verification of performance of the system in real apace. This system is applied to 31-story office building located in front of Akihabara station in Tokyo. Basically this system presents a research activity on development of sensor module. It equipped with MEMS acceleration sensor selected by the benchmark.

Structural monitoring is nothing but collection and analysis of structural response to ambient or forced excitation, in this data is collected at the centre node or on a single node for the centralized processing of that data. It describes the design and evaluation of a wireless sensor network system (Wisden) for structural data acquisition.
It incorporates two novel mechanism, reliable data transport and data-time stamping.
Fig 2 shows the Implementation of SHM on Golden Gate Bridge by Sukun Kim, Shamim Pakzad, David Culler, James Demmel, Gregory Fenves, Steven Glaser, and Martin Turon

Fig 2: Implementation of SHM on Golden Gate Bridge

A Wireless Sensor Network (WSN) for Structural Health Monitoring (SHM) is designed, implemented, deployed and tested on the 4200ft long main span and the south tower of the Golden Gate Bridge (GGB). Ambient structural vibrations are reliably measured at a low cost and without interfering with the operation of the bridge. Requirements that SHM imposes on WSN are identified and new solutions to meet these requirements are proposed and implemented. In the GGB deployment, 64 nodes are distributed over the main span and the tower, collecting ambient vibrations synchronously at 1 kHz rate, with less than 10us jitter, and with an accuracy of 30uG. The sampled data is collected reliably over a 46-hop network, with a bandwidth of 441B/s at the 46th hop. The collected data agrees with theoretical models and previous studies of the bridge. The deployment is the largest WSN for SHM.

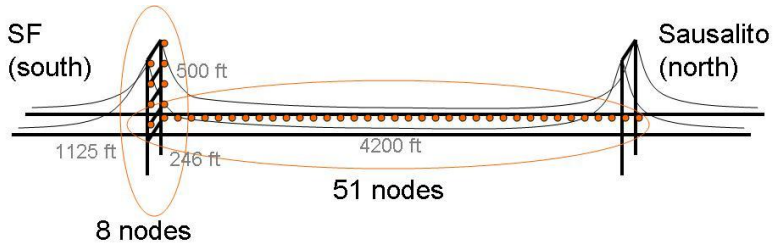


Fig 3: The Golden Gate Bridge and layout of nodes on the bridge

The Golden Gate Bridge and layout of nodes on the bridge. To cover this large bridge, long linear topology needs be used, and it brings challenges to the network.

Fig 4: Placement of actual system for SHM in GGB

Board enclosure, antenna, and battery installed on the main span. The zip tie had to be put around the antenna to control wind vibration. Poor link quality was experienced with vibrating antenna under strong wind. Corrosion of C-clamp can be observed in the figure.

IV. CONCLUSION

In this paper we presented a survey on use of networked embedded system for monitoring the health of personal health and structural health. Application of WSN in personal health and technical challenges were discussed. By this survey we conclude that wireless sensor has very emerging use for human health and structural health at low cost with more flexibility. Ubiquitous structural monitoring system applications for building and bridges for mitigation of seismic hazards, and implementation of SHM system in Golden Gate Bridge also discussed.

REFERENCES

[1] I.F Akyildiz, Su Weilian, et al. “A survey on sensor networks”. IEEE communication of the ACM, 2000, 43(5), pp. 51-58.
[2] I.F Akyildiz, Su, Y Sankarasubramanium and E. Cayirci. “A survey on sensor networks”. IEEE Magazine, 2002, (40), pp. 102-114.
[3] Danial Burmeister, Andres Schrader Darren Carlson “ A Modular Framework for Ambient Health Monitoring” in 7th International Conference on Pervasive Computing Technologies for Healthcare & Workshop 2013, pp. 401-405.
[4] Bieber, G. und Thom, A. DiaTrace – Neuartiges Assistenz-System for die Gesundheitspravention zurNacrungsaufinahme und Bewegungserfassung. “In proceeding of 1st german AAL Congress, Berline, Germany, January 2008.
[5] S. W. Doebling, C. R. Farrar, M. B. Prime, and D. W. Shevitz, “Damage Identification and Health Monitoring of Structural and Mechanical Systems from Changes in their Vibration Characteristics: A Literature Review,” Los Alamos National Laboratory, Tech. Rep., May 1996.
[6] Aleksander Milenkovik, Chris Otto, Emil Jovanov, “Wireless Sensor Networks for Personal Health Monitoring: Issue and Implementation”, Elsevier Publication 2006.
[7] T. J. Hodgetts and K. Mackaway-Jones, “Major Incident Medical Management and Support, the Practical Approach”. London, U.K.: BMJ, 1995.

[8] ISO 9919:2005 Medical Electrical Equipment-Particular Requirements for the Basic Safety and Essential Performance of Pulse Oximeter Equipment for Medical Use, Publication of the ASTM F29.11.05 and ISO TC 121 SC3 working group on pulse oximeters, Mar. 2005.

[9] Zhicheng Dai, Shengming Wang, Zhonghua Yan, "BSHM-WSN: A Wireless Sensor Network for Bridge Structure Health Monitoring", International Conference on Modelling, Identification and Controll, Wuhan, China, June 24-26, 2012.

[10] Narito Kurata, Makoto Suzuki, Shunsuke Saruwatari and Hiroyuki Morikawa, "Actual Application of Ubiquitous Structural Monitoring System using Wireless Sensor Networks", The 14th World Conference on Earthquake Engineering October 12-17, 2008, Beijing, China.

