

A Survey Paper on Issues in Wireless Sensor Network Applications

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Abstract:

Wireless Sensor Networks square measure utilized in variety of fields which incorporates military, healthcare, environmental, biological, home and alternative industrial applications. With the massive advancement within the field of embedded pc and sensing element technology, Wireless sensing element Networks (WSN), that consists of many thousands of sensor nodes that square measure capable of sensing, actuating, and relaying the collected data, have created exceptional impact everywhere. This paper presents an outline of the various analysis problems in WSN based mostly applications.

Keywords:

Wireless sensor network, task mapping, Smart parking, event detection, SHM, greenhouse monitoring, health care, C4ISR.

I. INTRODUCTION

Innovations in industrial, home and automation in transportation represent sensible environments. knowledge for sensible environments area unit obtained through Wireless sensing element Networks (WSN), wherever thousands of sensors area unit deployed at completely different locations operational in numerous modes[1] A sensor network is capable of sensing, process and communicating that helps the bottom station or command node to look at and react in line with the condition in an exceedingly particular setting (physical, battle field, biological)[2] Sensor network protocols have a novel self-organizing capability. Another attention-grabbing feature of WSNs is that the sensor nodes collaborate with one another. sensing element nodes have an in-built processor, exploitation that information ar processed before transmission. These options facilitate wide selection of applications of WSNs starting from medical specialty, environmental, military, event detection and conveyance telematics[3]. This paper presents an in depth summary of the research problems within the applications of Wireless sensing element Networks. Fig.1 depicts the summary of WSN applications.

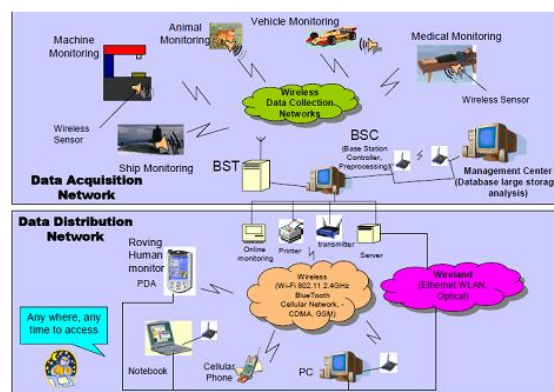


Fig. 1: Overview of WSN applications

II. RESEARCH ISSUES IN BIOLOGICAL APPLICATIONS

The WSN primarily based applications have created tremendous impact for biological issues. a number of these embody biological task mapping and programming, medical specialty signal monitoring etc. a short description of those applications has been conferred during this section

2.1 Biological Task Mapping

WSNs notice widespread applications within the space of biological sensing. Specifically, there's recent analysis going on within the conception of "labs on a chip", supported by latest technologies like nano-techniques. the utilization of WSNs for biological applications are accelerated thanks to the advancements in small Electro-Mechanical Systems (MEMS), embedded systems, microcontrollers and varied wireless communication technologies.

Y.E.M. Hamouda and C. Phillips [4] bestowed a BTMS (Biological Task Mapping and Scheduling) rule, in which a bunch of nodes was accustomed execute Associate in Nursing application. In this work, it had been assumed that the applying may be broken down into smaller tasks with totally different weights and hence a general model was thought of for complicated applications. so as to realize and enhance the specified performance objectives, assignment of resources to tasks is known as Task mapping and also the sequence of execution of the tasks is understood as task planning. Task mapping and scheduling area unit of a lot of importance in high performance computing. A near-optimal answer for task mapping are often obtained exploitation heuristic techniques. however the forced resources of WSNs need the look objectives to be different. but the simulation model that was designed was applicable providing the nodes within the WSN were separated with a distance set to 150m.

2.2 Biomedical Signal Monitoring

WSNs have revolutionized the sphere of medication in several ways. Telemedicine is that the field that involves the treatment and care of patients from a distance and conjointly aids in biomedical diagnosing. the applying of WSNs has significantly improved this field.

The basic principles and options needed at the time of development of a purposeful model for the watching of biological signals are conferred in [5]. To develop modern equipments for watching patients in foreign places using wireless technologies, the topology, sensors specific signal reception and analysis has been thought-about.

III. RESEARCH ISSUES IN COMMERCIAL APPLICATIONS

Some of the industrial applications of WSNs embrace vehicular observance, cultural property protection, event detection and structural health observance. These applications have a profound impact on normal regular affairs.

3.1 Smart Parking

WSNs are wide employed in the applications like intelligent parking for the needs like effective usage of existing parking heaps rather than creating big-ticket investments in new installations and to form provisions for coupling with low-cost sensor nodes which might track the vehicles effectively. Existing answer for parking application uses magnetometers and video cameras. The detections of magnetometers don't seem to be very correct as they're influenced by environmental factors. Video camera that is that the alternate is pricey and it's not feasible to transmit great amount of knowledge in an exceedingly wireless environment through multiple hops. Another issue that affects the appliance of magnetometers and video cameras is that in an exceedingly parking zone, except for entry and exit of vehicles there is also alternative moving objects that could be a nice challenge.

Detection of vehicles during a automobile parking space mistreatment magnetic sensors beside inaudible sensors along has been presented by S.Lee, D.Yoon and A. Ghosh in [6]. It was proved that correct transport detection was attainable with the combined use of inaudible sensors and magnetometers but it didn't offer any resolution for higher parking management.

A WSN based mostly sensible PARKing (SPARK) management system has been bestowed in [7]. observance of remote parking, mechanism for parking reservation and automatic guidance area unit a number of the newest options provided by the system. However, the system ought to be created fault tolerant, by incorporating mechanisms for characteristic defaulters

3.2 Vehicular Telematics

A detailed summary of transport telematics over heterogeneous wireless sensing element networks has been bestowed in [8]. during this work, a sophisticated design that collaboratively uses multiple radios and access technologies, known as Advance Heterogeneous transport Network (AHVN) design has

been mentioned. comfortable light-weight has been thrown on the assorted challenges and factors concerned in the development of the purposeful elements of AHVN and its connected protocols. These enclosed link management and congestion management, routing, security and different application development. so as to comprehend AHVN architecture for transport telematics over heterogeneous wireless networks the analysis problems to be explored embrace enhanced multi-

channel macintosh protocols for Dedicated Short Range communications(DSRC), dynamic spectrum sharing between DSRC and WiMAX, Heterogeneous wireless access for transport telematics, multimedia system transmission and Qos support and information congestion in transport telematics.

3.3 Security of Intra-Car

Fuel potency and reduction within the weight of automotives can be achieved by substitution wired sensors and their cables with wireless sensors. However, the inherent vulnerability of the wireless platform makes the protection problems with such a replacement, extremely questionable.

Security issues for intra-car wireless sensing element networks are self-addressed in [9]. In this work, choice of acceptable security algorithms for WSNs employing a systematic methodology and determination of the best combination with relevancy execution time and security has been given.

3.4 Event Detection

Tracking could be a typical characteristic of wireless device networks, particularly for immediate pursuit of events. Much work has been tired WSN, with device nodes having identical sensing units. However, the use of various types of device nodes is a region nonetheless to be explored. A fully distributed protocol cooperative Event Detection and Tracking (COLLECT), for event detection and pursuit in wireless heterogeneous device networks has been given in [10]. However, solutions to device node preparation, data dissemination and routing in Wireless Heterogeneous Sensor Networks (WHSNs) square measure the problems nonetheless to be addressed.

3.5 Structural Health Monitoring

The process of detection of injury for civil, aerospace and alternative engineering systems is said as Structural Health watching (SHM). Any modification within the material or geometric properties of those systems as a result of internal factors (aging) or external factors (natural calamities, pollution) is termed as injury. the conventional operation of Associate in Nursing SHM system includes low power, semipermanent watching of a structure to provide periodic updation of its health condition. However, during essential events like earthquakes and alternative natural disasters, period of time fast structural conditional screening will be done exploitation SHM system. A WSN primarily based application for long-term, on-line SHM primarily based science approach is given in [11].

A novel WSN primarily based application for SHM is bestowed in [12]. so as to try and do away with the constraints of ancient sensing networks, each the ability and knowledge interrogation commands square measure transmitted through a mobile agent, which is sent to every detector node to perform individual functions. Prototype systems wont to interrogate capacitive-based and impedance-based sensors for SHM applications are discussed during this paper. the development of WSN platform with vibration sensing and world Positioning System (GPS) positioning for SHM application has been bestowed in [13]. The challenges concerned in WSN primarily based application for SHM embrace rigid information measure necessities, extended network time period and limiting multi-hop knowledge exchange.

IV. RESEARCH ISSUES IN ENVIRONMENTAL APPLICATIONS

Environmental

applications embrace the observation of region para eters, trailing of the movements of birds and animals, fire detection, surround police work etc.

4.1 Greenhouse Monitoring

To ensure that the automation system in a very greenhouse works properly, it's necessary to live the native climate parameters at varied points of observation in several elements of the large greenhouse. This work if done employing a wired network can create the complete system clumsy and expensive. However, a WSN primarily based application for an equivalent purpose using many little size device nodes equipped with radio would be a price effective resolution. Such AN application has been developed in [14]. information analysis, DSP primarily based management solutions and a lot of advanced network setups square measure the areas nevertheless to be explored.

4.2 Habitat Surveillance

WSNs realize widespread application in home ground police work compared to alternative observance strategies attributable to high deployment density and organisation of the sensing element nodes. The advantage with WSN is that the invisible placement of sensor nodes within the home ground doesn't leave any noticeable mark which could have an effect on the behaviour pattern of the inhabitants. A WSN based mostly application together with General Packet Radio Service (GPRS) for home ground observance is introduced in [15]. the small print of a sensing element node that created use of the mix of ARM technology and IEEE

502.15.4 has been given. This paper addressed the energy management issue and developed a low-weight, constant duty cycle policy for energy management. However, developing a WSN based mostly application that may ne'er have an effect on the biological behaviour of the indweller species is extremely important, and thus a challenge to be thought-about

V. RESEARCH ISSUES IN HEALTHCARE APPLICATIONS

WSNs area unit terribly economical in supporting numerous regular applications. WSN based mostly technologies have revolutionized home and old attention applications. Physiological parameters of patients are often monitored remotely by physicians and caretakers while not touching the patients' activities. This has resulted in reduction of prices, improvement of equipments and higher management of patients reaping Brobdingnagian business edges. These technologies have considerably minimised human errors, allowed higher understanding into origin of diseases and has helped in making strategies for rehabilitation, recovery and the impacts of drug medical care. The recent developments within the application of WSN in attention area unit being bestowed. The implementation and analysis of a WSN based mostly e-Health application has been represented in [16]. the most analysis issue to be addressed is to extend the degree of awareness of home assistants, caregivers, primary attention centers, to understand the patients' health and activity standing to quickly discern and choose on the specified action. A simple localisation algorithmic rule supported device knowledge and Received Signal Strength Indicator (RSSI) was bestowed. This algorithm was proved by experimentation to figure fine in home environment. However, the utilization of multi-sensor analysis, that is predicted to convey higher accuracy, is a neighborhood nevertheless to be explored. A qualitative analysis on the perceptions and acceptance of aged persons concerning the usage of WSN for helping their tending is finished in [17]. A light-weight, low-cost WSN based mostly home tending monitor has been developed in [18]. an endeavor to integrate the WSN technology and public communication networks so as to develop a tending system for aged individuals reception while not worrisome their routine activities has been given in [19]. Improved performance with minimum call delay and smart accuracy victimization Hidden mathematician Model is nevertheless to be self-addressed.

A WSN based mostly home tending application is developed in [20]. the most issue that was thought-about during this analysis is the development of a operating model of home tending monitoring system with economical power, responsibility and bandwidth.

A WSN based mostly image device network for monitoring of health, with sensors for heart activity, using 802.15.4 grievance network nodes is represented in [21]. The issues relating to its implementation have additionally been mentioned.

The paper additionally describes the hardware and code organisation of the conferred system and provides solutions for synchronisation of your time, management of power and on-chip signal process. However, the area unitas that are however to be addressed area unit improvement in QoS of wireless communication, standardization of interfaces and interoperability. Specific limitations and new applications of the technology will be determined by in-depth study of different medical conditions in clinical and mobile settings.

Reference [22] presents the small Subscription Management System (μ SMS) middleware, using an event-based service model. This novel approach meets the design constraints of restricted resources, efficiency, measurability, dependability and low power consumption by implementing a dynamic memory kernel and a mechanism of variable payload multiplexing for the knowledge events to produce better services. it absolutely was determined that application of this approach yielded best results for e-health applications.

For continuous and time period observance of health Y.D. Lee and W. Y. Chung developed a wise shirt that measured cardiogram (Electro Cardio Gram) and acceleration signals [23]. The shirt was created of semiconducting materials to obtain the body signal as electrodes and consisted of sensors for on-line health knowledge observance. The determined and measured knowledge area unit transmitted in associate degree ad-hoc network for remote observance.

VI. RESEARCH ISSUES IN INDUSTRIAL APPLICATIONS

Nowadays, industrial applications square measure designed on distributed architectures and that they square measure needed to be cheap, flexible and dependable. The system's performance are often improved by interfacing sensors and actuators on to the industrial communication network, as knowledge and medical specialty can be created accessible to several systems and conjointly shared on the web. an in depth survey on the most recent developments in WSN based mostly industrial applications is bestowed in [24]. The WSN based

mostly industrial applications square measure shown in Fig. 2

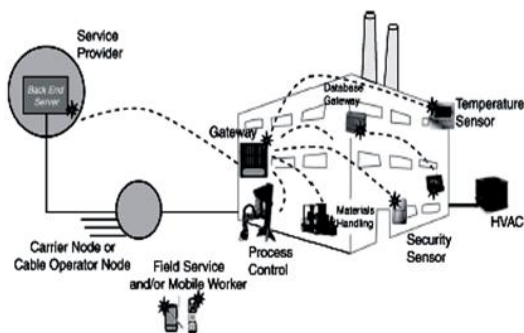


Fig. 2: Industrial applications

The applications of WSN in organic compound business primarily based on ZigBee technology has been mentioned in [25]. The application of WSN for safety observation of coal mines has been represented in [26]. Development of anti-interference and explosion-proof hardware is that the focus of additional analysis.

A WSN based mostly remote on-line Automatic Meter Reading (AMR) system is given in [27]. Latest technologies like wireless RF, ZigBee modules and Code Division Multiple Access (CDMA) telecommunication are employed in the remote metering technology. Direct access or physical reading of meters, so as to transmit the usage of parameters like electricity, gas, water etc. isn't doable forever. Hence, the solutions provided by WSN based mostly remote meters have remarkably modified the manner firms, organisations and individuals monitor water, gas and alternative resources.

WSN primarily based time period and distant energy observance and fault diagnosing in industrial motor system has been presented in [28]. Here the electrical signal primarily based motor signature analysis has been integrated with WSNs for best results. sensing element fusion of varied sensing element measurements, a comprehensive performance analysis of WSNs in industrial environments, analysis of the result of the network-error-control mechanisms square measure the areas nonetheless to be explored. A WSN primarily based approach is developed for detection of faults in metal cutting method in [29]. The machine tools can be maintained in fitness and therefore the incidence of wearing of tool is delayed by victimisation applicable monitoring systems. The mathematical model of the novel distributed WSN primarily based technique is delineated thoroughly in [29] and experimental results were enclosed that prove its effectiveness.

A WSN primarily based digital system for analysis of energy usage, condition observance, identification and higher-up control for electrical systems with Dynamic Power Management (DPM) are conferred in [30]. Two hardware topologies used for signal acquisition, processing and transmission kind the idea of this method. They are ISMs (Intelligent sensing element Modules) and RDAUs (Remote Data Acquisition Units). A Dynamic Power Management Protocol is enforced by sensing element nodes, to increase the WSN lifetime.

A WSN primarily based security system for an influence plant mistreatment human motion sensing element has been bestowed in [31]. Detection of trespassers and causation notification to administrator is that the important operate of the system. A WSN primarily based system for measuring and observance water quality is bestowed in [32]. Design of complicated underwater acoustic sensing element networks that may be employed in deep waters is a section nonetheless to be addressed.

VII. RESEARCH ISSUES IN MILITARY APPLICATIONS

WSNs play a significant role in military Command, Control, Communications, Computing, Intelligence, police investigation, Reconnaissance and Targeting (C4ISR) systems.

Few challenges faced by WSNs on the field square measure addressed in [33]. within the field, the WSNs square measure vulnerable to the attacks, wherever either the info or corrupting management devices square measure attacked, resulting in great deal of energy consumption and at last to the exit of nodes from work. The energy potency of device nodes and therefore the correct modelling of energy consumption square measure the analysis problems however to be explored.

WSN based mostly cooperative target detection with reactive mobility has been given in [34]. A device movement scheduling formula was developed and its effectiveness was proven mistreatment intensive simulations.

WSNs have found application in terribly essential applications like object detection and trailing. These applications need high detection likelihood, low warning rate and delimited detection delay.

VIII. CONCLUSION

An overview of the broad spectrum of applications of WSN has been given during this paper. The applying of WSN in the areas of medical specialty, intelligent parking, healthcare applications, environmental, industrial, and military applications are briefed. These attention-grabbing applications square measure doable owing to the pliability, fault tolerance, low value and fast preparation characteristics of device networks. tho' wireless device networks square measure strained by measurability, cost, topology amendment and power consumption, new technologies square measure being devised to beat these and to make device networks AN integral a part of our lives. A review on the assorted analysis problems concerned within the WSN applications has been made public. analysis on these problems can lead to promising results, creating WSN based mostly applications very standard. the applying of WSNs isn't restricted to the areas mentioned during this paper. the longer term prospects of WSN applications square measure extremely promising to revolutionize our everyday lives.

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International Journal of Engineering Research and Applications (IJERA) is **UGC approved** Journal with Sl. No. 4525, Journal no. 47088. Indexed in Cross Ref, Index Copernicus (ICV 80.82), NASA, Ads, Researcher Id Thomson Reuters, DOAJ.

Ms. R. R. Deshmukh A Survey Paper on Issues in Wireless Sensor Network Applications." *International Journal of Engineering Research and Applications (IJERA)* , vol. 7, no. 11, 2017, pp. 70-76.