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DISASTER MANAGEMENT IN WIRELESS SENSOR NETWORKS: A SURVEY REPORT

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Abstract

Wirelesssensor network is assumed as an essential part in Wireless information transmission. Because of its compacted size and vitality proficient structure of senor nodes that can adequately sent in a Wireless blunder inclined environment where these nodes can effectively transmit the catastrophe related detected information to sink nodes. These incidents of mass decimation regardless of the whether common cataclysms or man-made calamities cause an immense loss of cash, property and lives because of non-anticipating of Disasters. Therefore steps are required to be taken towards the counteractive action of these circumstances by pre deciding the reasons for these fiascos and giving fast protect measures once the Disaster happens. Disasters management and emergency services used to protect a person or society from the cost of disasters such as tsunami warning, landslide monitoring, earthquake rescue operation, volcano monitoring, and fire protection. Sensor systems may give a decent solution for these issues through effectively checking and all around coordinated reporting crisis occurrences to base station. Our aim to ponder distinctive sensor system conventions to determine some key specialized issues around there, thus identify the energy efficient Wireless Sensor Network (WSN) architecture for significant improvement of disaster management.

Keywords: Disaster Management, Sensor Networks

Introduction

WSNs typically consist of a large number of Sensor Nodes distributed over a certain region. Sensor Nodes have different vitality and computational requirements as a result of the organization of Sensor Node in unfriendly situations. Figure 1 shows a general architectural diagram of the Sensor Network. WSNs make simple observing and controlling of physical situations from remote areas. WSN have applications in an assortment of fields such as environmental monitoring, climate control, military surveillance, and structural health monitoring, medical diagnostics, disaster management, and emergency response, air pollution monitoring and gathering data in blunder inclined situations [1].

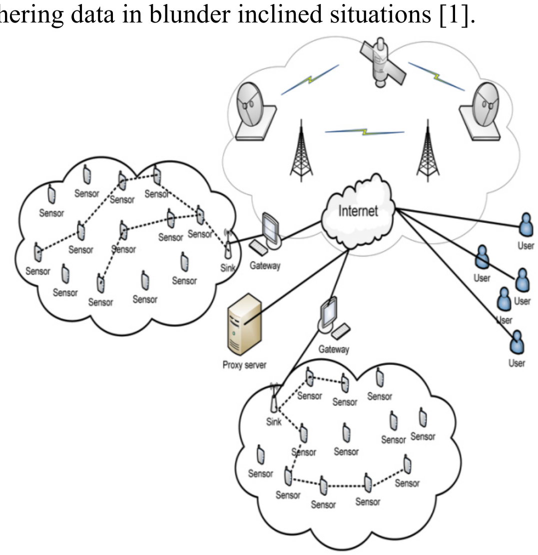

Figure 1: General Architecture of WSNs.

Disaster Management is an enormous assignment. They could barely encase to a specific area that neither do they vanish as fast they show up. It is important about proper management to optimize efficiency of planning and response. Due to limited resources collective efforts occurred. The level of affiliation requires a planned and sorted out push to militate against, get ready for, react to, and recoup from crises and their belongings in the briefest conceivable time.

Wireless ad hoc and Sensor Networks (WASNs) can significantly enhance situational awareness by improving and automating updates, monitoring and reacting to status changes, and amplifying information interchanges over the whole disaster. However, while WASNs have made significant contributions in surveillance [2], target tracking [3], and healthcare [4], but have not achieved broad application in disaster response. A few difficulties make their combination into this field troublesome

- To begin with, calamities are occasional, and the area, correspondences necessities, and detecting needs of the following catastrophe can't be anticipated. To succeed, WASNs supporting catastrophe reaction must be extensible, adaptable, versatile, and intended to influence and consolidate rising advancements.
- A second challenge involves scale and standardization. Small disasters, like a localized flood, normally involve resources from a single jurisdiction and are organized using simple ad hoc command and control.
- Lack of communication infrastructure is a third challenge faced in larger disasters. Entire regions suffer from degraded communication, and remaining capacity is exhausted by the demands of victims. Disaster responders must touch base station with their own correspondences. WASNs intended for catastrophe reaction must give standalone, powerful, and pervasive communications sufficient to support the geographic coverage and mobility requirements of its users.
- A final challenge involves the occasionally congested but normally dispersed and disconnected nature of disaster response activities. Responders are highly mobile and often scattered across long distances. Groups coalesce to solve manpower-intensive problems but quickly separate to continue search and rescue (SAR).

WSN can be useful to disaster management in two ways. Firstly, WSNs has empowered a more helpful early warning system and secondly, WSN provides a system able to learn about the phenomena of natural disasters. WSN innovation has the ability of quick capturing, processing, and transmission of basic information continuously in real-time with high resolution.

Efficient disaster detection and alerting system could reduce the loss of life and properties [5]. In the event of disaster, another important issue is a good search and rescue system with high level of precision, timeliness and safety for both the victims and the rescuers. Recently, WSNs have become mature enough to go beyond being simple fine-grained continuous monitoring platforms and get to be one of the empowering innovations for catastrophe early-cautioning frameworks.

Related Work

Land Slide prediction and monitoring

The landslide is a critical environmental process. Such process dependably happens each year and makes misfortunes of lives and properties. So study is needed to propose a system that can help to prevent the calamitous environmental process.

Landslide prediction and monitoring protocols were developed with the use of Energy efficient Sensor Networks. The Sensor Nodes are deployed in various areas which are classified into hierarchical zones. In the hierarchical architecture, the topographical information that are measured for the specific application are pore water weight, ground vibration, soil dampness, tilts or acceleration and strain on the specific Sensor section into which these simple sensors are set and covered under the ground. The Sensor nodes occasionally test the ecological information and transmit the information at steady time interims to the accumulating nodes.

In[6] author presented Fault Tolerant Energy saving clustering scheme in WSN for Landslide Area Monitoring to reduce Communication and processing overhead. The proposed approach, which arranges the entire system into Cluster and sub Cluster, bunches empowering a significant diminishment of

Communication and preparing overhead. Sub clusters formation also gives the possibility to deal skillfully with Sensor nodes, node leader, and Cluster head failures. Failed data prediction is being achieved by a fuzzy control system.

A new distributed clustering multi hop protocol, CAMP is proposed for landslide prediction. The cluster heads are selected with sufficient amount of energy, heads are dynamically changed. The creators moreover contrasted their proposed approach and customary LEACH convention to enhance the vitality utilization of Sensor Nodes [7].

In [8]effective information accumulation calculation is utilized to get the information accurately when disaster is happening. The distributed vector based detection with independent Cluster (DVBD-IC) algorithm stated that each CH (Cluster Head) sends the calculated LR to the Base station through multi hop. They accepted that the information from the nodes inside the Cluster associated yet the information from various groups are free.

In[9] author analyzed Landslide Area Using an image processing approach. By an elastic image registration and change-unchanged conditional statements appropriate for historical analysis of the land movement in a landslide area presented. Landslide recognized utilizing the quantity of pixel developments amid the enrollment process. It shows that the size of pixel movement used to detect changes in landslide areas. The additional sequences of changed pictures were utilized, and the more data about the historical backdrop of the territory can be accumulated.

Energy efficient Sensor network protocol for landslide area monitoring proposed in [10] explained Energy efficient modulation with two tier clustering architecture for the Fault Tolerant Sensor network. The enhanced lifetime of this convention can be valuable for the disastrous condition like Landslide Monitoring and administration.

Earthquake

To handle the earthquake flow, for example, very dynamical extent and variable source area, every sensor keeps up discrete factual models of recurrence range for various sizes of seismic sign vitality got by Sensor. Each sensor detects earthquake event every sampling period based on seismic frequency spectrum by the system architecture in Figure 2.

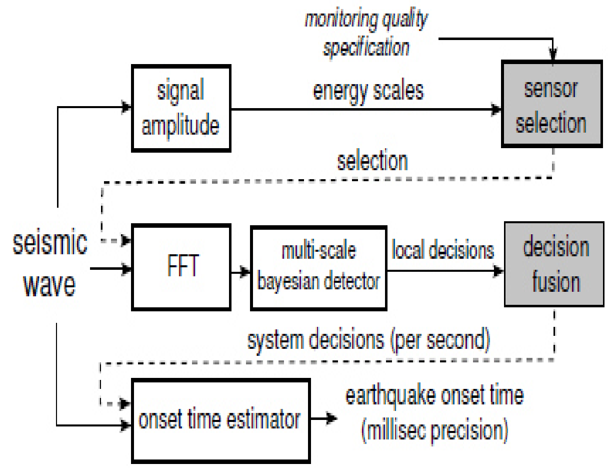

Figure2: System Architecture for the detection of earthquake [5].

Different studies show that the recurrence based finder has better location execution when the sensor gets higher sign vitality [11]. Accordingly, it is recommended that, the base station first chooses a negligible subset of instructive sensors in light of the sign energies got by sensors while fulfilling framework detecting quality prerequisites. The selected sensors then compute seismic frequency spectrum using Fast Fourier Transform (FFT) and make local detection decisions which are then transmitted to the base station for fusion. In addition to the detection of earthquake occurrences, node-level earthquake onset time is critical for localizing earthquake source. In this approach, the base station first distinguishes an individual seismic tremor and gauges a coarse onset time.

Flood Forecasting

Every year surges cause loss of a great many lives and billions worth of property in India. Although all these losses cannot be eradicated fully but the losses to lives and property can be reduced to barest minimum level, if the defensive measures can be taken before the disaster has struck as glimmer surges? Floods are the most common and widespread of all natural disasters. This can be made conceivable with the assistance of correspondence innovation utilized on the top of wireless sensor systems.

The system improvement includes the different stages and obviously, all stages are similarly essential. Beginning with the main period of information accumulation, level one is to manage the physical organization of detecting sensing devices on the riverbanks and usage of a powerful restriction plan contingent upon the circumstance and environment.

Level two manages the setup of nearby base stations and with information correspondence at area level. Level three could be involved with the central monitoring system at the headquarters to process acquired data. Data analysis then takes place either at headquarter or at outside research centers that particularly do high-risk flood analysis. Figure 3 shows various phases used for monitoring system.

In[12] author proposed simple flood forecasting scheme using WSN which presented a forecasting model designed using WSNs to predict flood in rivers which use multiple variable robust linear regression which is easy to understand and cost effective .

Implementation is speed efficient, however has low asset use but then gives constant forecasts dependable precision.

LANDSATand SPOT data would be usefulonly under cloud-free situations. SAR, which is locally available ERS and RADARSAT satellites, can give pictures amid the day or night, notwithstanding.

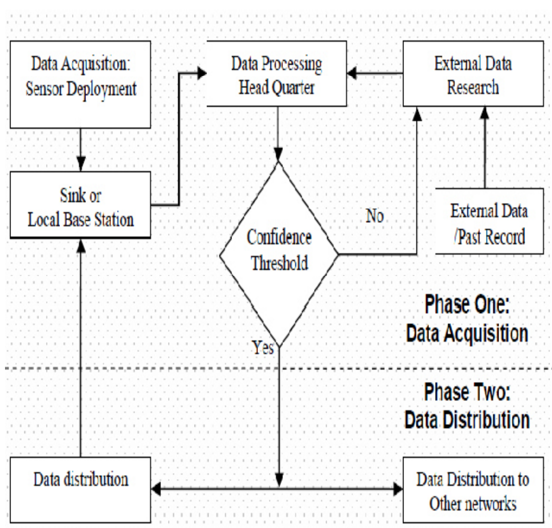

Figure3: Smart System aided with WSNs [5].

Nearness of dimness, light rain, snow, mists or smokes. LANDSAT and SPOT data would be useful only under cloud-free situations. SAR, which is locally available ERS and RADARSAT satellites, can give pictures amid the day or night, notwithstanding nearness of dimness, light rain, snow, mists or smokes.

However, a large number of satellite sensors abroad both meteorological satellites and earth observation satellites can be used to estimate flood-related hydrological variables such as snow cover, water elevation, rain rate, soil moisture, solar radiation, surface, land cover and surface temperature. Satellite symbolism can be exceptionally viable for surge administration in the accompanying way:

Detailed mapping that **is** required for the production of hazard assessment maps and for input to various types of hydrological models;

- Developing a larger scale view of the general flood situation within a river basin or coastal belt with the aim of identifying a immediate assistance.
- Damages, in terms of properties and crops, are assessed with the help of existing land use base map.
- Flood prediction through obscuration of clouds and snow cover.

Forest/Residential Fire Detection

In spite of the fact that it is practically difficult to put off raging fires, yet the catastrophe can be turned away given the data about the site of the flame can be promptly sent to the closest control focus and sufficient measures be taken to control it, before it inundates everything. An extensive number of Sensor Nodes are thickly sent in the backwoods. These Sensor Nodes are composed into groups so that every node has a comparing cluster header. Sensor Node can gauge environment temperature, relative mugginess and smoke. They are also assumed to know their location information by equipment's such as Global Positioning System GPS. Every Sensor Node sends measurement data, as well as the location information, to the corresponding cluster head. The cluster header figures the climate record utilizing a neural system technique and sends the climate file to the manager node through sink. The sink is associated with a manager node through a wired system. A few wind Sensor Nodes are manually deployed over the forest and connected to the sink via wired networks to detect wind speed [13]. The manager node provides two sorts of information to users: (1) Emergency report for unusual occasion (e.g. smoke or to a great degree high temperature is distinguished); (2) real-time forest fire danger rate for each cluster based on the weather indexes from the cluster header and other forest fire factors.

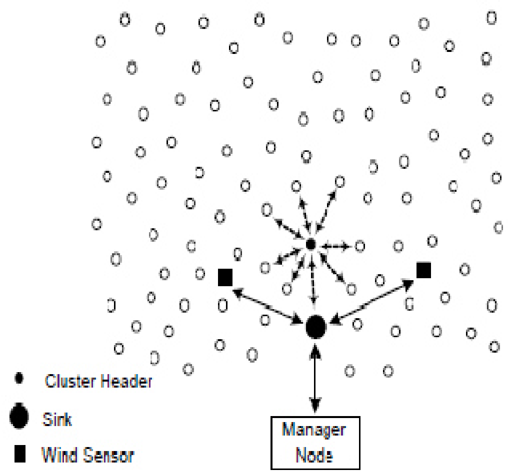

Figure4: A WSN for real-time forest fire detection [5].

Artificial intelligence techniques are used to detect residential fire more accurately. Use of techniques like feed forward neural network is used in which output of one detected event is set as input for other as reference. This feed forward mechanism helps to detect the event with fast and accurate manner. Distributed Bayesian calculation is utilized to recognize event in proficient way with less number of issues. This calculation for the most part evacuates shortcomings in the transmission of information and identification. Event Location in decentralized way can help framework in extraordinary degree [14]. Collective methodology for event discovery is utilized. No brought together framework is working. Information is not gathered to the sink halfway, rather every node is autonomous caution framework which can sense the event, prepare the information and distinguish the event separately. Computerized reasoning procedures like FFNN are utilized to distinguish private fire all the more precisely. Utilization of systems like feed forward neural system is utilized as a part of which yield of one recognized event is set as information for different as reference. This feed forward component distinguishes the event with quick and exact way. Fire detection is done by remote sensing mote and different combinations of sensors are used to detect the fire. Main function is to separate fire sources from noise sources to remove unnecessary chaos in the networks [15].

Wireless Sensor Network for Tsunami Detection

A system for tsunami detection and mitigation using a wireless ad hoc sensor network defines three types of nodes: sensor, commander, and barrier. Generally extensive number of Sensor Nodes gathers submerged pressure readings across a coastal area. This information is accounted for to authority nodes which analyse the pressure data and predict which, if any, barriers need to fire. Despite the fact that it is difficult to totally stop a tidal wave, author proposed utilizing various obstructions which might be locked in to diminish the effect of the wave.

A calculation as recommended by author in [16] has been actualized which utilizes a general relapse neural system (GRNN) as endorsed to foresee the way of the wave. The GRNN analyzes the pressure data from sensor nodes and predicts which barriers should fire to most effectively impede the tsunami. It likewise utilizes a continuous reaction component for dissemination.

Wireless Sensor Network model for Drought Forecast

More watering system strategies have just about got over the issue of dry season, however like numerous other creating and under-advantaged nations, India too is reliant on downpour divine beings for the regular downpours to meet their prerequisites of water for watering system purposes. The suggested model is based on an intelligent system called Drought Forecast and Alert System (DFAS), which is a 4-tier system framework composed of Mobile Users (MUs)[17], Ecology Monitoring Sensors (EMSs), Integrated Service Server (ISS), and Intelligent Drought Decision System (ID2SDFAS joins the remote sensor systems, inserted mixed media interchanges and neural system choice advancements to successfully accomplish the forecast and alarm of the dry season. DFAS analyzes the drought level via the proposed drought forecast model derived from the Back-Propagation Network algorithm. The dry season derivation components are 30 day obliged precipitation, every day mean temperature, and the dirt dampness to enhance the precision of estimating dry spell. These deduction components are distinguished, gathered and transmitted progressively through the Mote sensors and versatile systems. Once a region with possible drought hazard is identified, DFAS sends altering messages to users' appliances. System implementation results reveal that DFAS provide the drought specialists and users with complete environment sensing data and images. DFAS makes it possible for the relevant personnel to take preventive measures, e.g., the adjustment of agricultural water, for a reduced loss.

Distress Net

ICS is an arrangement of rules for sorting out debacle reaction. It gives institutionalized yet adaptable mechanism to manage the development of synergistic groups fit for cross-jurisdictional coordination. ICS also provides a framework of common processes supporting integration of resources from different organizations into cohesive teams. Sensor networks have been deployed to a variety of challenging environments. ExScal [2] and VigilNet [18] are two such systems. ExScal conveyed more than 1200 elements in an open air checking application with a static preplanned topology. VigilNet, with roughly 200 nodes, utilized a static however spontaneous topology in a comparative exertion. Both activities utilized for the most part homogeneous equipment.DistressNet requires greater scalability, more heterogeneity, and higherdegrees of mobility. AlarmNet is deployed in an assisted living environment, offers a heterogeneous network of static and mobile elements deployed across a confined area. Not at all like DistressNet, AlarmNet depends on altered foundation covering limited ranges. Code Blue, another therapeutic framework, depends on settled base in for the most part indoor zones. DieselNet [5], a transport based postponement tolerant system (DTN) with a high level of portability along unsurprising courses, depends on the nearness of a lot of 802.11 base. Conversely, DistressNet expect accessibility of no outside base along its changed erratic courses.

Distressnet by specially appointed remote sensor system design for circumstance administration in a disaster reaction. Situational mindfulness in a disaster is basic to powerful reaction. Disaster responder requires convenient conveyance of high volumes of precise information to settle on right choices. To address these issues, Distressnet, that backings calamity reaction with appropriated collective detecting, topology mindful steering utilizing a multichannel convention, and precise asset limitation.

Vehicle

To acquire clearing arranges in the dynamic system, we utilized a model of departure issue and an arrangement of calculations to create dynamic clearing arranges, taking into account continuous data got from sensors and other observation innovations. Presently, in the most research writing, scientific models for clearing issues are arranged into two groups: microscopic models and macroscopic models. Microscopic models are used for experimental analyses by simulation of behaviors of individual residents [19]. Typical such microscopic models are cellular automata simulation models and probabilistic models for pedestrians and traffic movement. While in macroscopic models, which do not directly treat the behaviors of individual evacuee but treat them as a homogeneous group, that is to say, each evacuee have the same speed and we rely on drivers' discretion to choose among multiple feasible links if giving them the right signal. There are several classes of mathematical macroscopic models such as static networks, discrete-time dynamic networks and continuous-time dynamic networks.

Alert Systems

In[20] author present WSN weather and disaster alarm systems that can be used to prevent enormous damage from natural disasters. In this framework, Wireless sensor system in view of Zigbee/IEEE802.15.4 standard is used as climate station sending climate data and Disaster's ready. The climate data is broke down by utilizing choice tree methods to declare the disaster's ready.

Conclusion:

This survey studies the role of sensor network in disaster management. It furthermore studied the different types of disaster management protocols and their application in extremely disastrous conditions. The performance such protocols are studied based on Energy efficiency, location awareness and network lifetime.

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