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Implementing Adaptation and Reconfiguration Method in WSN: A Review

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ABSTRACT: This work provides a review on network reconfiguration in wireless sensor network using controller. A routing protocol designed for WSN should have the ability of adapting to different applications and different network conditions it uses the concept of dynamic reconfiguration routing protocol that achieves the need of various applications and also various network conditions. As the result, it can be widely used in a military application for battlefield surveillance wireless sensor network has been an area of active research with many civilian application, fire detection, where it is difficult for humans to reach and once they are deployed, they work on their own and serve the data for which they are deployed In disaster control. The main objective of this work is to design mobility based network reconfiguration system in WSN. Localization is one of the most important applications for wireless sensor networks since the locations of the sensor nodes are critical to both network operations and most application level tasks**.**

KEYWORDS**:** WSN System, Routing protocol, Dynamic Reconfiguration System, Localization, Mobility Management etc.

I. Introduction

Human strive for the understanding and control of the environment has led to the development of smart monitoring systems known as Wireless Sensor Networks (WSNs). A wireless sensor network (WSN) is a wireless network consisting of spatially distributed autonomous devices using sensors to cooperatively monitor physical or environmental conditions, such as temperature, sound, vibration, pressure, motion or pollutants, at different locations. Originally developed as a military application for battlefield surveillance wireless sensor network has been an area of active research with many civilian application covering areas such as environment and habitat monitoring, traffic control, vehicle and vessel monitoring, fire detection, object tracking, smart building, home automation, Wireless sensor networks gather data from places where it is difficult for humans to reach and once they are deployed, they work on their own and serve the data for which they are deployed. These systems have been evolving during the last decade into more efficient and adaptable solutions to face a wide range of different scenarios [5].

With the development of micro-sensors and low-power wireless communications, the technology of WSN is becoming increasingly mature step by step. An efficient routing service is a must require for all the applications running on the WSN platform. A lot of routing protocols specially designed for WSN have been proposed. The typical protocols include Gossiping Protocol, Sensor Protocols for information via Negotiation (SPIN), Directed-diffusion Routing, Greedy Perimeter Stateless Routing (GPSR), and Trajectory Based Routing (TBF). These routing protocols are all different from those protocols designed for the traditional.

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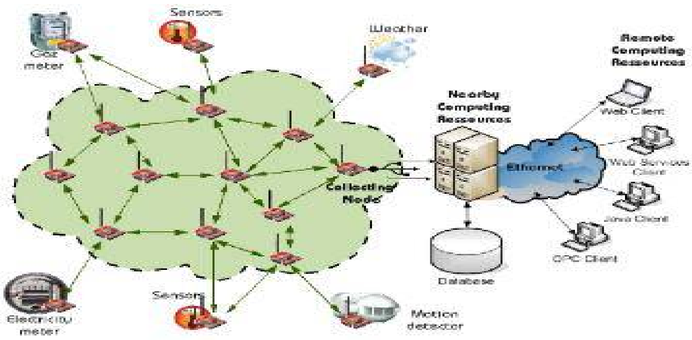

Figure 1: Deployment in Wireless Sensor Networks [17]

Some protocols cannot meet the requirement, because they are designed to meet some specific goals. As the result, they cannot give the QoS guarantee for all the applications. At the same time, the QoS requirement of an application will be changed sometime though its whole life cycle.

Localization is one of the most important applications for wireless sensor networks since the locations of the sensor nodes are critical to both network operations and most application level tasks. The main parameter is the localization error of nodes. So, when all nodes get back to their location after disaster control, there have some localization error but this value must be less for better response.

The paper is ordered as follows. In section II, it represents related work of mobility based dynamic reconfiguration system in WSN network. In Section III, It defines the dynamic reconfiguration scheme. The proposed system is defined in section IV. Finally, conclusion is explained in Section VI.

II. RELATED WORK

From the survey, it can be obtained that a routing protocol designed for WSN should have the ability of adapting to different applications and different network conditions. If we can change the routing protocol remotely according to the applications' requirement and the network conditions, can achieve this goal. Currently, it is very difficult, if not impossible, to change a routing service in a large scale sensor network because the service is statically pre-configured into each node, which is often unattended. So, it proposes a mobility based network reconfiguration system in WSN which can be dynamically reconfigured. This protocol will give the administrator of the WSN a powerful ability. With this great ability, the administrator can change the routing protocol remotely to adopt different applications and different network conditions.

Some Authors [1] proposed the concept of node relocalization in sensor network using embedded controller. It proposes mobility based dynamic reconfiguration system in WSN. The main objective is to reduce the localization error in system. By providing access for the user to construct different virtual fields, proposed protocol accomplishes the goal of meeting the need of different applications and different network conditions. All nodes are in dynamic nature and moves randomly.Some authors [2] proposed the mobility based dynamic reconfiguration system in WSN. It uses the concept of dynamic reconfiguration routing protocol that achieves the need of various applications and also various network conditions. In this all the nodes are in dynamic nature and moves randomly. All nodes are communicating with each other as well as from head nodes. It provides a multi-hop routing based on shortest path in wireless networks. A controller is designed which is used to control the movement and location of nodes.Some Authors [3] proposed the localization is one of the most important applications for wireless sensor networks since the locations of sensor nodes are critical to both network operations and most application level tasks. It proposes mobility based dynamic reconfiguration system in WSN. By providing access for the user to construct different virtual field, proposed protocol will accomplish the goal of meeting the need for environmental monitoring and data collection. The proposed mechanism will be implemented with MATLAB.Some [4] proposed the ISO/IEC/IEEE 21451 family of standards has recently awakened its interest in the development, making easier the introduction of both characteristics in the design of wireless sensor nodes. Dynamic reconfigurability is an exciting topic that is gathering interest for development of embedded systems and smart sensor nodes. The use of dynamic reconfiguration increases the scalability and heterogeneity capabilities of the sensor network.Some [5] proposed proposed DRRP, a routing algorithm with the

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ability of dynamic reconfiguration. By providing access for the user to construct different virtual potential fields, DRRP accomplishes the goal of meeting the need of different applications and different network conditions. To make the effect of our routing protocol more excellent, set a parameter, which can be changed dynamically, to influence the virtual hybrid potential field. By regulating the parameter according to the situation, can optimize the routing protocol constantly.Some [6] proposed an accurate and efficient localisation method that makes use of an improved Received Signal Strength Indicator (RSSI) distance estimation model by including the antenna radiation pattern as well as nodes orientations is presented. Mathematical models for distance estimation, cost function and gradient of function that can be used in a distributed localisation algorithm are developed.Authors [7] a framework to dynamically reconfigure the WSN and adopt its power consumption, transmission reliability, and data throughput to different requirements of applications. The framework makes it possible to specify, at design time, distinct network, MAC and radio protocols for each application as well as the events and policies triggering the WSN reconfigurations. At run time, the WSN automatically reconfigures itself in response to these events and according to these policies. The author proposed approach can reconfigure the whole the whole network in few hundreds of milliseconds while incurring little memory and control overhead.Some [8] introduced a session-to-mobility ratio (SMR)based mobility management scheme. The scheme enables the MC to send location update message to the gateway, uses forward chain, tunnelling and a threshold SMR value for reducing the cost of mobility management. The effect of selection of the threshold SMR on cost per handoff, cost per packet delivery and total communication cost per time unit have been investigated.Some [9] presented and evaluate different approaches for the distribution of mobility management functionalities. Initiate mobility decoupling from the most common split into data and control planes and splitting in control plane of mobility management into location and handover management. Evaluate the distributed approaches, based on the proposed decoupling, and compare them with the most adopted fully centralized approaches.Authors [10] proposed the introduction of the dynamically reconfiguration buses, the architecture gained a popularity for its high its high performance computing with general propose processor used. It is a powerful model of computation in which communication pattern between the processors could be changed during the execution.

III. Mobility Based Dynamic Reconfigurable System

A wireless sensor network (WSN) is a self-organized system of small, independent, low cost, low powered and wirelessly communicating nodes dispersed over an area having sink nodes taking the data from sensor nodes and may handle a variety of sensing, actuating, communicating, signal processing, computation, and communication tasks, deployed in the absence of permanent network infrastructure and in environments with limited or no human accessibility. The WSN nodes have no fixed topology, but they can configure themselves to work in such conditions.

1. Development of WSN

To design a WSN application, knowledge of many elements of the context is essential as they influence the operation greatly. During the development of such a WSN, it is unknown which influences the nodes might experience, which nodes might crash, and how long exactly the sensor nodes will last with the available energy. Because of these uncertainties, the quality of service of the WSN might develop over time like the solid line in Figure 1.

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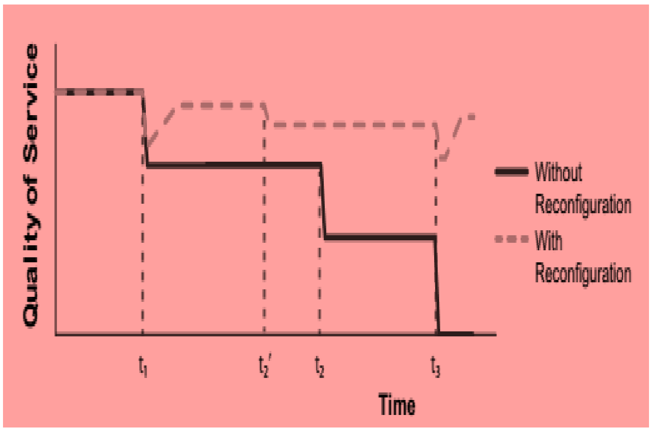

Figure 2: Conceptual Decrease in Quality of Service by Context Changes [2]

Initially, the WSN will perform well because the context matches the expectations during development. However, at some point t1 after deployment, a sensor node might have changed position because of some external event, making its sensor readings less accurate and the WSN decrease its performance. Also, another node might experience high interference, resulting in many retransmissions from that node. The higher energy consumption can cause the battery to run out at t2. If eventually at t3the node that aggregates sensor information and transmits it to the base station crashes, the complete WSN will be rendered useless.

The WSN could notice one of its sensors is generating inaccurate results at t1 and either adjust its sensitivity or disable its sensor to prevent incorrect readings. At t2, the node that is experiencing much interference could detect the higher energy demand. By increasing the length of its duty cycle, it can avoid completely running out of energy at t2, with only a small decrease in performance. Additionally, if a component providing important functionality crashes, the functionality could be transferred to another node, in which case the WSN could continue to run after t3. In this way, a developer does not have to determine the exact configuration, sensor accuracy or other properties at design time. It can delegate these choices to the network, and let them be determined at run-time. Reconfiguration can increase the lifetime and suitability of a WSN in a changing context [2].

2. Need for Dynamic Reconfigurable System

Reconfiguration means adapting (sub)components or their arrangement within a system. Wireless sensor networks gather data from places where it is difficult for humans to reach and once they are deployed, they work on their own and serve the data for which they are deployed. When the environment changes, sensor network should change too. For an example, it is meaningless, if the sensor network is collecting data of rainfall in the months of January-March in India. However, the same network could be utilized to gather temperature data for the same period. Or at least we should stop retrieving data of rainfall.. Since bug fixes and regular code updates are common to any software development life cycle. There is also a need to reconfigure the nodes so that they can keep generating relevant information. Hence a set of protocols, applications and operating system support are needed to reconfigure wireless sensor networks remotely [10].

3. Node Localisation Parameters of WSN

Localisation is one of the most important applications for wireless sensor networks since the locations of the sensor nodes are critical to both network operations and most application level tasks. Determining the location of nodes is one key application of Wireless Sensor Networks (WSN), for both civil and military applications. Most of the research efforts have focussed on the improvement of the localisation accuracy and complexity.

The first step for determining the location of a node is to find the distances between the respective nodes, which are assumed to be mobile, and some other nodes, which are assumed to be stationary. This is the so-called ranging phase.

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A. Error Introduced By Radiation Pattern

The error introduced by the antenna radiationpatterns can be expressed as shown in equation (1).

$$RSSI_{ij(Measure)} = RSSI_{ij(Actual)} + Ant_{Err} \qquad (1)$$

$$Ant_{Err} = Rad\ Patt_i(\varphi_i) + Rad\ Patt_j(\varphi_j) \qquad (2)$$

Where $RadPatt_i$ and $Rad\ Patt_j$ antenna radiation patterns (in dB) of node i and node j respectively.φ_i and φ_j represent the actual node bearing in the same coordinate system as the antenna radiation pattern.

B. Calculate the correction of node

The distance between the data points is calculated using Euclidean distance as follows. The Euclidean distance between two points or tuples,

$$X1 = (x11; x12; : : : x1n)$$
$$X2 = (x21; x22 : : : x2n)$$
$$Dist\ (X1,X2) = \sqrt{\sum_{i=1}^{n}(x1i - x2i)^2}$$

In the network, every anchor node has accurate location information, so that you can use the known information between two anchor nodes to calculate the correction. The distance between two anchor nodes can use formula to seek and get average hop distance (calibration value) in the network, the correction spread in the network by using the method of flood, each anchor node pass own calibration value to the nearest unknown node.

$$H_i = \frac{\sum_{i\neq j}\sqrt{(xi-xj)^2-(yi-yj)^2}}{hij} \qquad (3)$$

Where, $H_i$called average jump distance of anchor node,h_{ij}called the min hop between two anchor nodes.

C. Location error analysis

For unknown nodes' localization operation, estimate locations and the theory location of node will appear different results, this also called positioning error.

As shown in formula (4), each node positioning error is that use the location of the actual estimate and the real value of the node position to calculate as the follow equation:

$$Error = \frac{\sum_{i=1}^{n}\sqrt{(xcal-xreal)^2+(ycal-yreal)^2}}{n} \qquad (4)$$

The positioning error of the unknown node divided the ratio of the nodes in the wireless range is the positioning accuracy. In this the main consideration result is position error, the change of position precision and size to determine the positioning accuracy of improved algorithm and the original algorithm [6].

4. Mobility Parameters of Sensor Nodes

Mobility of Sensors Nodes Mobility is the major factor that affects the performance of the protocol. Due to high mobility of the nodes, unnecessary control information is exchanged and that can degrade the performance of entire network. Due to the excessive node movement in the network, it may be unstable and control overhead increases.

A. Session-to-Mobility Rate (SMR) Calculation

Session-to-mobility ratio (SMR) is defined as the ratio of session arrival rate to mobility rate. A session is a stream of consecutive packet at the IP layer. The SMR_{MC} value can be calculated as,

$$SMR_{MC} = (ts/ta)$$

Where (ts) is Residence time of the mesh client (MC), each MC will have an active state timer ta. If time duration between the receiving of two consecutive packets is greater than ts, the current packet is considered as the first packet of a new session. Otherwise, the packet belongs to the ongoing session. Mobility rate is the mesh router (MR)crossing rate of the MC [9].

B. Packet Loss

While an MN experiences its handover, data packets destined for the MN will be lost if any buffer management at network sides does not exist. The amount of packet loss $\varphi p^{(.)}$during a handover is defined as the sum of all lost data packets sent from a CN of the MN. Then, it is expressed as follows:

$$\varphi p^{(.)} = \lambda s E(S) L_{HO}^{(.)}$$

Where $\lambda s$is the average session arrival rate at the MN's wireless interface and $E(S)$ is the average session length in packets.

Due to mobility there may be: - Routing information loss, Congestion, Contention, Variation in routing load, Variation in throughput all above factors can affect the overall performance of routing load as well as the output of entire network and in the case of clustered network, it becomes more difficult to maintain the performance of network. So there is need to have an efficient mobility control algorithm for the network [8].

5. Application of Mobility Based Dynamic Reconfiguration System

The main objective of this work is to design mobility based self-network reconfiguration system in WSN. It is used in many applications such as Environmental observation and forecasting may include volcanic studies and eruption warning system, flood detection, meteorological observation, earthquake studies and warning system, cyclone and tsunami warning system, water quality monitoring etc.

A good warning system can help to avoid the damages caused by natural disasters. Sensor nodes can be used to monitor the conditions of plants and animals in wild habitat, as well as the environmental parameters of the habitat. Sensor can be deployed under water or on the ground to monitor the quality of air and water. Air quality monitoring can be used for air pollution control and water quality monitoring can be used in biochemistry field. Sensors can also be deployed to detect natural or non-natural disasters. For example, sensor nodes deployed in a forest can also detect the exact origin of the fire before the fire is spread uncontrollable. Seismic sensors can be used to detect the direction and magnitude of earthquakes.

IV. PROPOSED SYSTEM

In this paper, we proposed the WSN nodes have no fixed topology, but they can configure themselves to work in conditions such asthe absence of permanent network infrastructure and in environments with limited or no human accessibility. Routing protocol designed for WSN should have the ability of adapting to different applications and different network conditions. To change a routing service in large scale sensor network propose a mobility based network reconfiguration system in WSN which can be dynamically reconfigured. It reviews the present mechanism of dynamic reconfiguration. Localization is one of the most important applications for wireless sensor networks since the locations of the sensor nodes are critical to both network operations and most application level tasks.The main parameter is the localization error of nodes. So, when all nodes get back to their location after disaster control, there have some localization error but this value must be less for better response.

IV. CONCLUSION AND FUTURE WORK

This work presents a review on network management system based on reconfiguration using controller. This work presents how to design a routing protocol, which can meet the need of different applications and different network conditions, is an extremely challenging problem. With the help of dynamic reconfiguration, the routing protocol can be changed by the remote administrator according to the need of different applications and different network conditions. In this work, all nodes are communicating with each other. A head is provided for giving the instructions to all nodes. The need for reconfiguration architecture for sensor network applications is apparent from the results of even a simple environmental monitoring algorithm. The main performance parameter will be localization error. With the help of this, it may prove the better stability of system. Ittakes the scenario of safety under wireless network. Due to this, it will provide safety and also minimum location error.

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