

2014

BioTechnology

An Indian Journal

FULL PAPER

BTAIJ, 10(24), 2014 [15067-15071]

The routing protocol research which based on ad hoc network

Lu Wenhai^{1,2*}, Wu Yue³, Xiang Xianquan²¹Ocean University of China, Qingdao, 266100, (CHINA)²National Marine Data and Information Service, Tianjin, 300171, (CHINA)³National Center of Ocean Standards and Metrology, Tianjin, 300112, (CHINA)

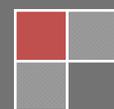
E-mail : lu-wenhai@163.com

ABSTRACT

Wireless ad-hoc network is a temporary autonomous networks, distributed node of its network is determined by the characteristics of the convenience and widespread popularity. But one issue is caused by a routing protocol security and stability, a large number of nodes in this open structure is vulnerable to outside attacks. Traditional virtual location based routing protocol has the advantage of speed, but there safety questions. For this reason, this article proposes and designs are characterized by a high security routing protocol based on virtual location, which improved distance correlation node-positioning algorithms is used. Simulation using NS2 simulation software sees it as virtual location-based routing protocol than traditional security 20%. The computation algorithm Protocol is no significant decline.

KEYWORDS

Wireless network; Node-positioning algorithm; Virtual location; Routing protocols.



INTRODUCTION

Wireless Ad-Hoc Network is a new type of wireless communication network, which is composed of terminal consists of a set of wireless transceiver device of the self-organization of multi hop temporary autonomous system of equations. Wireless sensor nodes deployment process is controlled, the node working area is often human doesn't fit into the area, in this case, the sensor node is need through the aircraft scatters, the location of the sensor node has randomness and uncertainty. In most application areas, such as in the military field, the location of the node information is the key to the battle command, without the support of location information, the tactical information there will be no meaning; In earthquake, forest fire monitoring, if there is no accurate to obtain the region of node information, such as temperature, magnetic field intensity, the pressure, can bring unexpected disasters; In medical care, accurate access to nodes to perceive the information such as the patient's body temperature, blood pressure, heart rate, can real-time monitor the patient's condition, the condition to carry on the comprehensive evaluation; In aquaculture, if cannot be accurately measured in the area of chemical concentration, temperature and so on node information, may bring great harm to breeding users^[1,2]. In other words, there is no location information monitoring news often is meaningless, only clear the location of the information, can for the subsequent processing to provide complete decision support system.

THE ROUTING PROTOCOL FOR WITELESS AD HOC NETWORK CHARACTERISTICS

In many cases, wireless ad hoc network and other network interconnection. At present we most commonly used localization algorithm in energy consumption, cost, and adopted a compromise deal with positioning accuracy, but because the application of different occasions, also takes different conditions, there is no a localization algorithm can generally suitable for a variety of different applications. Node positioning problem, therefore, has become a wireless AD hoc sensor network is an important research direction, should according to different applications, comprehensive consideration to choose the most suitable localization algorithm.

Wireless ad-hoc network is a set of nodes through the organization form of no canter network, the network does not rely on the default of the infrastructure, network nodes use their wireless transceiver interactive information, not in each other's communication coverage when communication node, with the help of other nodes relaying to implement the data grouping of multiple hops^[3-6]. In the research literature about wireless ad-hoc Network, the following English name often appears: Ad hoc Network, Multi - hop Network, Self-organizing Network, Infrastructure less Network, Packet Radio Network. The network name from different sides reflects the nature of the wireless ad-hoc network is different from other online features: temporary, existing in the network multiple hops, self-organization, does not depend on infrastructure, packet radio forwarding, etc. At present the most commonly used is the Ad hoc Network.

Sensor node is a tiny embedded device, in order to reduce power consumption, lower the price, it must demand the computing and storage capacity is relatively weak. Therefore, how to reduce the computational cost and storage cost under the condition of implementing node positioning accuracy become one of the main problems in today's wireless sensor network research. For wireless AD hoc sensor network, the network topology control has a great influence on the network performance, network mode to a certain extent, determines the overall topology of network. Good topology can improve the efficiency of routing protocol and MAC protocol, for data fusion, time synchronization and target positioning, and provides the foundation, reduce communication interference, many aspects is helpful to prolong survival time of the whole network.

At present, the main topology control technology can be divided into time control, space control and logical control. Time control by controlling each node sleep, work duty ratio, adjust the sleep time between nodes, nodes to work alternately, to achieve the purpose of save money; Space control by controlling node sends power to change the connected area, make the network presents different connecting forms, control energy consumption, improve the effect of the network capacity; Logic control is will not be "ideal" nodes, forming a more robust, reliable topology control.

THE TRADITIONALVIRTUAL LOCATION ROUTING PROTOCOL

Distance based positioning distance or angle measured by the nodes of point-to-point information to calculate the node position. Censored localization algorithm has the advantage of easy implementation, computation quantity is small, completely based on the network connectivity, but the algorithm need more beacon nodes. DV - Hop algorithm is by the D.N coalesce and B.N lath the, put forward the calculation method of unknown node position is divided into three stages: packet radio beacon node contains its own position, all nodes receiving and forwarding packets, at the same time record the minimum Hop count to the beacon node; Beacon nodes in the network average hop distance, then in the form of packet broadcast to the network, the unknown node according to the received the average hop distance information calculation to the anchor node and the hop distance; Unknown nodes using the second phase of each beacon node distance jump distance, the trilateral measurement method or maximum likelihood estimation method to calculate its own position. DV - Hop algorithm use the jump section instead of the actual distance of sensor node hardware requirements low, implementation is simple. Its disadvantage is that the average every hop distance calculation error is bigger, directly affect the positioning accuracy of unknown nodes. The first stage and the DV - Hop algorithm is the same. Radius of the second stage, the assumption that the network communication under the same conditions, the average every hop distance as the communication radius, when calculating the unknown node to each beacon node distance jump section number. APIT algorithm principle is, first of all nodes with multiple unknown triangle area is

determined, and then the triangle area of a polygon centered as the location of the unknown node. APIT algorithm is the theoretical basis of PIT test. If M point along A direction can at the same time close to or far away from the triangle vertices A, B, C, then you can judge M point located in the delta ABC outside; Otherwise, the M point located in the delta ABC internal. According to measuring node distance or position adopted by the method, can be divided into: Time of Arrival (TOA), Time Difference of concatenated (TDOA), Radio Signal Strength (DV - HOP) and Angle of Arrival (AOA), etc. Based on the signal of Angle of arrival Angle (AOA) positioning principle is the receiving node through multiple ultrasonic receiver nodes to sense or antenna array launch signal do, so as to estimate the relative orientation between nodes receiving and launch or Angle information, through triangulation method is used to calculate the position of the node. Weakness is AOA influenced by external environment, and the need for additional hardware (and ultrasonic receiver antenna array), and is not suitable for large-scale wireless AD hoc sensor networks. Based on Signal receiving Strength (DV - HOP, a Received Signal Strength Indicator) ranging principle launch of node is known Signal Strength, the receiving node according to the Strength of the Received Signal, calculates the Signal in the transmission loss, and then using the theory and experience of Signal propagation loss into distance information transmission model, reuse of the existing localization algorithm to calculate the unknown node location. The technology is a kind of low power consumption

Cheap technology, simple implementation, conform to the trend of the development of wireless sensor network (WSN), has been widely used. But in practice the DV - HOP positioning technology are susceptible to temperature, obstacles, such as propagation model, the influence of error can cause the receiver to produce eyes, so it still need further improvement.

Centralized algorithm (Centralized Computation) is refers to the required information is transmitted to a central node, through the calculation of center node to node localization algorithm. Of centralized algorithm is its overall planning from the global Angle, the position of the node positioning accuracy is relatively high, but the disadvantages are obviously include poor system scalability, when adding new nodes or node failure, the location of the need to recalculate all the nodes in this system, increased the network energy consumption, led to the center node and the network communication interrupt, unable to realize positioning. Distributed computing (Distributed Computation) is to point to each node through the exchange of information between nodes and coordination, calculated by the node itself, the positioning of the way. The advantages of this algorithm is to change the network topology structure has a strong adaptability, without support of center node, is conducive to the expansion of the system.

Tight coupling is refers to the anchor node positioning algorithm through cable medium to connect to the controller at the centre of the localization algorithm; Loose coupling is refers to the node positioning algorithm adopts a distributed localization algorithm of wireless coordination center controller. Such as Cricket, Haloes is loose coupling location algorithm proposed in recent years. Such localization algorithm relies on coordination and exchange of information between nodes to achieve localization, adopt the way of information exchange to obtain its own location information, so will interfere with each other for competitive channel between the nodes, the positioning accuracy is not high, and does not apply to large-scale sensor networks. Due to traditional DV - Hop algorithm, DV - HOC after a period of time after searching for size, information content will cause some path than other path of information content, so that you can fall into local convergence condition. The algorithm increases the mutation operator is $0 < q < 1$ in order to avoid the DV - HOC search early in hysteretic phenomenon. When the random number $0 < q < 1$ or less, DV - HOC choice is according to the formula 1 to select next.

THE MODIFIED ROUTING PROTOCOL BASED ON VIRTUAL GEOGRAPHIC LOCATION

Location based routing protocols is coexist, the advantages and disadvantages of specific sum up the advantages and disadvantages respectively, there are two, this section in to carry out specific analysis on the advantages and disadvantages of this paper on the basis of geographical location routing protocol based on virtual layer are briefly discussed. The following advantages: small forward delay. The algorithm in addition to joining a mutation operator, also for DV - HOC adopted a strategy rewards and punishment, to reach the destination node is the ultimate endpoint of DV - HOC punishment strategy. When the DV - HOC search path after the search, eventually to the node is not the purpose of what we need, that the DV - HOC search path search task is failed, so the DV - HOC failure, in order to avoid the back of the DV - HOC also make the mistake, the algorithm for this DV - HOC passes through in the process of searching path to punish residual information on hormone levels, as far as possible to make the probability of this path is selected is very low, the efficiency of the algorithm.

The algorithm and general DV - Hop algorithm has a difference, is the algorithm better or residual pheromone on the path to relatively poor are global adjustment. On the optimal path to global pheromone update is the cause of, is to be able to make the best path can be a better choice, through strengthen the information content of these elite path, the DV - HOC rev to an exciting role, lead to DV - HOC tend to be the best path. Instead, also the pheromone on the path of the poor is also the cause of the global adjustment, also is to let DV - HOC give up to search on these paths, turned to the other without being search path, to increase the diversity of choice. The strategies to strengthen the optimization ability of the algorithm at the same time guarantee the results of optimization.

In DV - Hop localization algorithm, the first use of unknown node distance vector exchange protocol to calculate the minimum Hop count of the unknown node and beacon node, on the basis of the existing formula and then estimate the distance of every jump, use the minimum Hop count multiplied by the average every Hop distance and estimated distance between the unknown node and beacon node, reuse the trilateral measurement method or maximum likelihood estimation method to calculate the coordinates of the unknown nodes. Generally divided into three stages:

Phase 1: first, using the distance vector exchange routing protocol, to obtain the unknown node and the minimum hop count each beacon nodes. In order to get to the hop count between nodes, a beacon node contains its location information (the initial value of 0) and the hop broadcast packets to all neighbours node. Document with the receiving node to each beacon nodes, the minimum hop count from same beacon nodes (ignoring the larger hop), then jump number plus one, continue to forward to its neighbour node (in addition to the source direction), the process continue, until the network each node for each beacon node location information and the corresponding numerical. That is we are going to use the basic principles of compound node location technology. Neighbourhood, the blind area information fusion process is shown in figure 1.

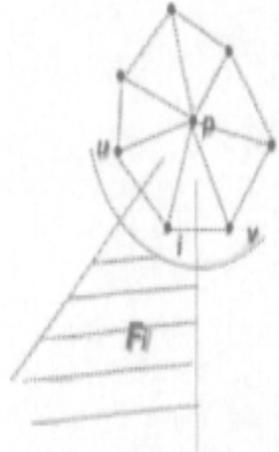


Figure 1 : The neighbours schematic blind area of information fusion

Assuming N1, N2, N3 for beacon nodes, node A is the need to position of unknown node, N1, N2, N3 three beacon node knows the distance between each other, 30, 25, and 40 respectively. Actual distance of 10 A to N1, hop count to 1; A to the actual distance of N2 10 + 15 + 15, hop count to 3; A to N3 actual distance of 10 + 10 + 15, hop count to 3. DV - Hop algorithm is as follows:

(1) The N1, N2, N3 broadcast packets contain their position, accept points recorded N1, N2, and N3, the minimum hop count and forward.

(2) The N1, N2, N3 according to record information on other beacon nodes and hop count, estimated network every jump distance: N1: $(25 + 30)/(4 + 4) = 6.9$; N2: $(30 + 40)/(4 + 6) = 7$; N3 $(25 + 40)/(4 + 6) = 6.5$, then the N1, N2, and N3 will broadcast to the network, the network average jump distance 6.9, 7, 6.5, respectively, A record only received the first average jump distance, because it is A to the distance of the N1, therefore the first to receive A 6.9 average jump distance as A network. Finally A calculation to N1, N2, N3, respectively from N1: $6.9 * 1 = 7.5$; From the N2: $6.9 * 3 = 20.7$; N3 distance: $6.9 * 3 = 20.7$.

(3) The trilateral measurement method is used to estimate the position of it

A to N1 the actual distance is 10, but through the DV - Hop algorithm to estimate the distance of 6.9, error obviously increases, which leads to A unknown through the trilateral measurement method to estimate its position deviation is larger.

The algorithm for multicast routing in Ad Hoc network on the implementation of the steps:

(1) For each node in the network, each link set good QoS value. At the same time constraints of a given bandwidth, delay, delay jitter value, will not meet the constraints in the network link delete, to get a network topology structure, and then routed to the new network topology search.

(2) Will be initialized pheromone in the network topology, at the same time set is the same, to set an initial value $\tau(r, s)$. Set a maximum cycle number N, for the first time cycles were initialized to 0. DV - HOC search at the beginning, let to DV - HOC before part starting from the source point, for each of the former to the DV - HOC has generated a taboo list, the source node is in the table.

(4) Each of the former to the DV - HOC choose search path using the state transition of the algorithm formula, once after the search loop, the DV - HOC announced failure, some after the DV - HOC, at this time of DV - HOC searches, prior to the path of the information content of local adjustment.

(5) For DV - Hop repeat step (4), wait for DV - HOC are finished their diameter and local pheromone update after.

6 out of DV - Hop search path, the path of the selected optimal and worst, according to the global updating rule on the path

Update global pheromone adjustment. IEAMRA fusion is the basic ideas of evolutionary algorithm and improve the DV - Hop algorithm, the advantages of network topology on wireless ad-hoc network, first of all, according to the evolutionary algorithm to produce in advance some relatively optimal routing, and then based on the evolutionary algorithm to seek out a better solution, based on the use of DV - Hop algorithm to search again. Which on the evolutionary algorithm to search a better routing assignment first pheromones, another way to avoid premature convergence is also based on the Max -

min DV - HOC algorithm to set initial pheromone values, and then on the basic framework, with improved way of path and pheromone update strategy to solve QoS in wireless ad-hoc network constrained multicast routing problem.

THE SIMULATION ANALYSIS

NS2 simulation program implemented by two languages: c++ and Tell (Tool Command Language). Figure 8 To 40 CBR stream IEAMRA algorithm and basic genetic DV - Hop algorithm (GAAC) the movement of nodes at time 0 ~ 500 s in the end to end delay comparison results between the figure, the abscissa of the residence time is refers to the movement of the nodes in the wireless self-organized network pause time, is relative to the movement of nodes to stay longer that the topology of the network structure is more stable. Can be seen from the diagram and the pause time within 0 ~ 100 s, this thesis IEAMRA the average latency than GAAC, movement speed, at first, this is because the node routing reconstruction, frequent IEAMRA USES the most stable route for transmission, routing reconstruction of frequency decrease a lot. As the residence time is more and more long, the delay of the two algorithms gap is gradually reduced, thereby indicating IEAMRA more adapted to the dynamic wireless ad-hoc network environment. Mobile area is 1500 meters by 900 meters, the total number of nodes is 50, 50 by the mobile node and 10 static nodes. 50 mobile node in mobile area according to the Random Waypoint movement model, the dead time is 0 seconds, top speed is set to 0,5,10,15,20 m/s, has set up five mobile scenarios. 10 the stationary node as CBR stream source node or the destination node, placed at the edge of the rectangular area, in the process of simulation always remain static. Each of the CBR stream data packet from the source node to destination node, on average, need eight to jump. For each mobile scenarios, respectively set up three traffic scene: the first scenario only a CBR is established between two stationary node flow, the second scenario three CBR is established between 6 stationary node flow, and the third scenario in ten five CBR stream between stationary node. CBR packet size of 512 bytes, transmission speed for 4 group/SEC. The simulation time is 900 seconds, random repeat 5 times for each simulation scene, and average as the final test results.

In general the existing wireless sensor network node the following constraints:

(1) The sensor node energy limited.

Sensor node is a tiny embedded devices, through carry energy limited battery power, and the sensor node work area is usually a human does not fit into the area, so can't through the way of artificial replacement battery powered, so energy saving is particularly important. Communication module working state of the wireless AD hoc sensor networks have send, receive, idle and sleep four. Four kinds of state of the energy consumption each are not identical, delivery status consumption; most sleep the least energy consumption. Therefore, in the future design of wireless AD hoc sensor networks module work, want to consider these factors, avoid unnecessary forwarding and receiving, enter sleep state when don't need communication, can save the unnecessary energy consumption.

(2) The sensor node communication ability is limited.

(3) The sensor node's computing and storage capacity is limited.

Sensor node is a tiny embedded device, in order to reduce power consumption, lower the price, it must demand the computing and storage capacity is relatively weak. Therefore, how to reduce the computational cost and storage cost under the condition of implementing node positioning accuracy become one of the main problems in today's wireless sensor network research. For wireless AD hoc sensor network, the network topology control has a great influence on the network performance, network mode to a certain extent, determines the overall topology of network. Good topology can improve the efficiency of routing protocol and MAC protocol, for data fusion, time synchronization and target positioning, and provides the foundation, reduce communication interference, etc many aspects is helpful to prolong survival time of the whole network.

CONCLUSIONS

First in wireless ad-hoc network routing protocol has carried on the theory discussion and the node localization technology, first of all, from the overall analysis of the traditional DV - HOP algorithm positioning principle and problems of the algorithm, and made some improvements aiming at the shortcomings of the existed. Experiment firstly, conform to the practical application of signal propagation model, and then choose higher precision triangle censored algorithm. Through the simulation experiment of the improved method was compared, the results concluded that the improved algorithm has obvious advantage in location accuracy and reliability. This algorithm is compared with traditional wireless ad-hoc network routing protocol algorithm has higher reliability, and it can than the current wireless ad-hoc network has an average of 500 hours continuous trouble-free working time up to 600 hours.

REFERENCES

- [1] Candès E 2006 Compressive sampling. Proceedings of the International Congress of Mathematicians, Madrid, Spain, 3 1433-
- [2] Wetter M 2011 Journal of Building Performance Simulation 4(3)185-203
- [3] Rodriguez R I, Jia Y 2011 International Journal on Smart Sensing and Intelligent Systems 4(2) 325-37
- [4] Haifeng D, Xiaolong Z 2012 International Journal on Smart Sensing and Intelligent Systems 5(4) 824-42
- [5] Geziei S 2008 A survey on wireless position estimation, Wireless Personal Communications, 44(3) 263-80