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Multi-Hop Networks With Wireless Communication

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Abstract:

Wireless conversation suffers from interference, low bandwidth convenient, low data rates compared to wire line, and signal fading. In such military actions, tactical wireless system required high demands for robustness, responsiveness, reliability, availability and security. Four network paradigms can be classified as wireless multi-hop networks. we will present an overview of wireless multi-hop networks along with brief introductions to these four wireless multi-hop network One of the key requirements of the tactical user expectation is to efficiently utilize the available bandwidth. This will consume the system bandwidth thereby throughput will be reduced. Moreover, hop by hop routing method will reconstruct the entire IP packet by changing the destination MAC address in every hop thereby packet processing time will be increased. IP packet routing in the tactical wireless system which are connected via IP radios consume more system bandwidth in order to maintain the up-to-date information. This will consume the system bandwidth thereby throughput will be reduced. Moreover, hop by hop routing method will reconstruct the entire IP packet by changing the destination MAC address in every hop thereby packet processing time will be incremented.

Keywords — **Multi-hop, Routing protocol, packet forwarding, Wireless communication.**

I. INTRODUCTION

Wireless communication via radio signal has been involved in military operation since the World War I. Telegraph radios were installed on ship and shore to provide wireless communication over long distance. A radio was carried on an airplane to provide communication between a pilot and grounds headquarter. The reliability of the wireless communication at that time was very low, which made it less attractive in military operations. During World War II, wireless communication had been evolved rapidly. Voice communication through wireless channel became more reliable. Each deployed force must be equipped with a portable radio to provide communication between forces. The wireless technologies during that time were based on analog signals and operate in point-to-point or broadcasting manner. In the current stage of military wireless communication, the technologies are based on digital technology. Current wireless communication is not only capable of transmitting voice but also capable of transmitting data. The demands for data transmission over wireless channel have been increased, since various information such as troops' position and sensor data is needed to be shared among military units to provide situation awareness in the area without network infrastructure. As a result, wireless networking has been integrated to the system to provide sharing of information of deployed units. Wire network is still existed along with wireless network as a backbone network.

II. REVIEW OF LITERATURE

II.1 military science Wireless Network visualisation necessities and Representations

Yougen Zhang ; Yingchun Shi Tactical wireless communication network, that has hailed because the system of the field, is a vital suggests that of linking numerous combat platforms (especially mobile platforms) been and supporting cooperative engagement. thanks to the big variety of network members, numerous platforms sorts, numerous data interactions, high manoeuvrability of members, and also the influence of tract and magnetic force surroundings on communication channels, military science wireless communication network is characterised as complicated and time-varying.

II.2 IP Packet Forwarding Mechanism of Network

R.T.Shylaja, S.Rajagund, V.Vipurjal One of the key requirements of the tactical user expectation is to efficiently utilize the available bandwidth. IP packet routing in the tactical wireless networks which are connected via IP radios consume more system bandwidth in order to maintain the up-to-date information. Complex routing protocols have to be implemented in the radio as embedded software modules in order to exchange the IP routing information. This will consume the system bandwidth thereby throughput will be reduced. Moreover, hop by hop routing method will reconstruct the entire IP packet by changing the destination MAC address in every hop thereby packet processing time will be increased.

II.3 Performance analysis of the augmented wireless sensor network testbed

Y.Abulhazim , T.Rajakumar, V. Bimal Patel

Existing testing systems are not suited for testing of tactical hardware in complex battlefield configurations due to the increased complexity of sensors that include network interfaces and sensor fusion algorithms. We are developing a system for augmented testing of wireless sensor networks that supports virtual system configurations interacting with the real-time hardware in the loop.

II.4 Network Lifetime Enhancement of Multi-Hop Wireless Network

Sethu Lakshmi P, Jibukumar M G, and Neenu V S Wireless Sensor Networks (WSN) can be made more energy efficient by adopting multihop communication rather than single hop communication. Relaying heavy data traffic through nearby nodes of sink arises energy holes which is very crucial to prolong network lifetime. This paper propose an efficient RF energy harvesting scheme using multiple dedicated RF sources to avert energy holes. The work aims to 1) Optimally place the energy transmitters and 2) Determine optimal number of energy transmitters required to avoid energy holes in multihop WN.

III. ALGORITHM

III.1 Fuzzy C means

Algorithmic steps for Fuzzy c-means clump
Let X = be the set of knowledge points and V = be the set of centers.
step1) willy-nilly choose ‘c’ cluster centers.
step2) Calculate the fuzzy membership 'µij' using:
step3) cypher the fuzzy centers 'vj' using:

$$\mu_{ij} = 1 / \sum_{k=1}^{c} (d_{ij} / d_{ik})^{(2/m-1)} \longrightarrow 1$$

$$v_j = \left(\sum_{i=1}^{n} (\mu_{ij})^m x_i\right) / \left(\sum_{i=1}^{n} (\mu_{ij})^m\right), \forall j = 1,2,\ldots..c \longrightarrow 2$$

step4) Repeat step 2) and 3) till the minimum 'J' price is achieved or $\|U(k+1) - U(k)\| < \beta$. where,
‘k’ is that the iteration step.
‘β’ is that the termination criterion between [0, 1].
‘U = (µij)n*c’ is that the fuzzy membership matrix.
‘J’ is that the objective operate.

III.2 K-Means Algorithm

Let X = be the set of knowledge points and V = be the set of centers.
1) arbitrarily choose ‘c’ cluster centers.
2) Calculate the space between every datum and cluster centers.
3) Assign the information purpose to the cluster center whose distance from the cluster center is minimum of all the cluster centers.
Choose the amount of clusters (K) and procure the information points
2. Place the centroids Ce1, ce2,.. cek arbitrarily x

(x,y)=1/mn ∑_((s,t)∈s,xy)g(x,t) $\longrightarrow$ 1

Repeat steps four and five till convergence or

till the top of a hard and fast variety of iterations
4. for every datum Y_i: nearest centroids(c_1, c_2 .. c_k) point to it cluster
S[i,j]= 〖Σ_(i=-r)^n C(i,j+f) $\longrightarrow$ 2

Where i=1, j=3, r=4,t=1

$H(t)=1+COS(t), -\pi \le t \le \pi$ $\longrightarrow$ 3

5. for every cluster i = one.j new centroids= mean of all points allotted to it cluster
6. End.

IV. PROPOSED SYSTEM

IV.1 IP Packet Forwarding Mechanisms

Each tactical wireless radio node will be provided with unique integer identifier. This identifier value will be used to uniquely identify the individual wireless radio nodes. Since the radios are connected to the LAN, during power on, each wireless radio node will get to know the associated LAN IP Address/MAC Address from the Gratuitous Address Resolution Protocol (ARP). This Gratuitous ARP will be sent by the IP device to the connected radios whenever the Ethernet link changes. After receiving the Gratuitous ARP from the associated LAN, the wireless radio node will extract the either associated LAN IP address or MAC address.

IV.2 IP Trace in Multi-hop Nets

The parameters such as unique radio identifier and the associated LAN IP address or MAC address will be used in topology discovery process to discover the network topology using link state routing algorithm. The link state routing algorithm will exchange messages to allow each wireless radio to learn the entire network topology. After successful topology discovery, each wireless node in the network will come to know the entire network topology in terms of a table containing connectivity list along with their associated LAN IP address/MAC address. This topology discovery table will be used in forwarding the IP packet from one radio network to another radio network. The IP/MAC Address to Node ID mapping table will be used to find the destination radio Id from the incoming IP packet. Each wireless radio maintains its own identifier value, network connectivity table and IP Address/MAC address to Node Id mapping table. To enable broadcast and multicast feature these radios also knows the broadcast Id value and the multicast mapping table.

IV.3 Packet Forwarding Procedure

If the particular radio is a relay for the given source and destination, then the header packet will be reconstructed by updating the transmitting radio node id as its own node id and other parameters such as duplicate packet detection identifiers, If the destination radio Id is matching with its own radio Id After updating the header, the packet will be transmitted over the air. In this process, the IP header will not be changed. If the particular radio is not a relay node for the given source and destination then the packet will be dropped. Then the radio header will be removed and the IP packet will be given to its connected LAN. If the destination radio Id is not matching with its own radio Id, then the radio checks whether the radio is a relay for the source radio id to the destination radio Id. Upon receiving the radio packet from the wireless domain, the received radio node decodes the radio header portion.

IV.4 Packet forwarding charge

It is assumed that the energy transmitters are Omni directional. The amount of energy charged by sensor nodes depends on the transmit power of energy transmitter, harvesting circuit and propagation properties of the environment. In terrestrial environment, obstacles of different sizes cause reflection, refraction, and scattering of signals. Thus, the path loss in terrestrial environment is higher than free space path loss and can be modelled as

$$\frac{\partial^2 F}{\partial^2 x} = F(x+1) + F(y+1) - 2(F(x)y$$

where d^2 is the distance of a reference location from transmitter with measured path loss)(dL 00 which depends on the signal frequency, d is the physical distance between transmitter and receiver, ω is the path loss exponent for the radio environment and the Gaussian random contributor X f with zero mean and standard deviationσ , represents shadowing effects.

4.5 Optimal Placed Energy Transmitter

The main objective of optimum placement of energy transmitters is, to give maximum energy to relay nodes and to maintain a minimum energy level to all nodes. However, simultaneous optimization for maximum energy charged and energy distribution may not be possible always.

In order to avoid energy holes in multihop WSNs, we have to enhance the lifetime of relay nodes. So the placement of energy transmitters will be in such a way that,

$$U\{x_e, y_e\} = \alpha \sum_{i=1}^{N_S} \sum_{e=1}^{N_E} E_{C_{i,e}} + (1-\alpha) \min_{\forall j \in \{1,2,\ldots\ldots N_S - 1\}} \sum_{e=1}^{N_E} E_{C_{j,e}}$$

they are placed near the sink where energy hole area exists.

For the optimal placement of energy transmitters we adopt utility function, to maximize the energy charged by relay nodes and to maintain a minimum energy level among all nodes. The utility function for the first energy transmitter placed at position },{ ee yx is given as, It is observed that the utility

$$\{\hat{x}_e, \hat{y}_e\} = \arg\min_{\{x_e, y_e\}} \sum_{i=1}^{N_1} \sum_{e=1}^{N_E} E_{C_{i,e}}$$

function is maximized when energy charged by relay nodes is maximized. If we place the remaining energy transmitters based on (7), the network criteria will get altered. Due to this rest of the placement is done in energy deficient areas of network by satisfying the minimum energy constraint

(EC) .

V. CONCLUSION

Wireless energy transfer is a prime technique to sustain the operation of sensors in WSNs. This uncertainty is due to high node movements, intermittent interferences, and hostile attacks. We proposed a dedicated RF energy harvesting technique to decrease the energy constraint of relay nodes in multihop communication. Ideal number of energy transmitters are optimally placed in the network. Tactical wireless networks are characterized by its operation in hostile environment, which has a large-magnitude uncertainty. The optimal placement not only guarantee minimum energy among all sensor nodes but also delivers more energy for relay nodes to overcome their energy constraint for forming energy holes around the sink.

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