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Extracting Topology Preserving Maps Layout from Virtual Coordinates in Wireless Sensor Networks

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Abstract:

The main objective of this project is obtaining topology-preserving maps (TPMs) from virtual coordinates (VCs) of wireless sensor networks. Virtual coordinates (VCs) provide an economical alternative to geographical coordinates for routing and self organization of large-scale wireless sensor networks (WSNs). This project proposes the TPM from the virtual co-ordinates. In a virtual coordinate system (VCS), a node is identified by a vector containing its distances, in hops, to a small subset of nodes called anchors. And extract the virtual co-ordinates. Topology coordinates provide an economical alternative to physical coordinates for many sensor networking algorithms.

1. Introduction:

Localization (sometimes referred to as “l10n”) is the process of adapting a product or content to a specific locale or market. Translation is only one of several elements of the localization process. Routing is the process of selecting best paths in a network. In the past, the term routing was also used to mean forwarding network traffic among networks. However this latter function is much better described as simply forwarding. A technique for handling matrices (sets of equations) that do not have an inverse. This includes square matrices whose determinant is zero and all rectangular matrices. Virtual coordinates (VCs) provide an economical alternative to geographical coordinates for routing and selforganization of large-scale wireless sensor networks (WSNs).

A wireless sensor network (WSN) of spatially distributed autonomous sensors to monitor physical or environmental conditions, such as temparature, sound, pressure, etc. and to cooperatively pass their data through the network to a main location. The more modern networks are bi-directional, also enabling control of sensor activity. The WSN is built of "nodes" – from a few to several hundreds or even thousands, where each node is connected to one (or sometimes several) sensors. Each such sensor network node has typically several parts: a radio transceiver with an internal antenna or connection to an external antenna, a microcontroller, an electronic circuit for interfacing with the sensors and an energy source, usually a battery or an embedded form of energy harvesting. A sensor node might vary in size from that of a shoebox down to the size of a grain of dust, although functioning "motes" of genuine microscopic dimensions have yet to be created. The cost of sensor nodes is similarly variable, ranging from a few to hundreds of dollars, depending on the

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complexity of the individual sensor nodes. Size and cost constraints on sensor nodes result in corresponding constraints on resources such as energy, memory, computational speed and communications bandwidth. The topology of the WSNs can vary from a simple star network to an advanced multi-hop wireless mesh network. The propagation technique between the hops of the network can be routing or flooding.

2. Related Work:

I. F. Akylidi [1] This paper presents the internet of nano-things by using the nano networks architecture. It is mainly based on the bottom–up design of nano networks. First the properties of the nano material's quantum effects are taken and then the channel models for communications are taken. Then protocols for the networks are designed. J. Bachrach [2] This paper presents the localization in sensor networks by using the hop counts, time difference of arrival, angle of arrival and digital compasses. By using the range, hop counts and the time these techniques it used to locate the sensor networks nodes. Y. Bengio [3] This paper presents the out-of-sample extensions for LLE, Isomap, MDs, Eigenmaps, and spectral clustering by using the multi-dimensional scaling, spectral clustering, laplacian eigenmaps, LLE and Isomap. From the eigenvectors the eigenfunctions are formed and then the spectral clustering and the lapacian eigenmaps are extended. D. C. Dhanapala [4] This paper presents the topology preserving maps from virtual coordinates for wireless sensor networks by using localization and topological preserving. In localization it mainly focuses on the global localization and the actual positions of a subset of nodes. In topology preserving, it mainly focuses on the preserving of the nodes not in the node distances. It is done by the Cartesian coordinates and topological maps. R. Hartley [5] This paper presents the multiple view geometry in computer vision using the projective geometry and transformation. For this, the direct linear transformation and iterative minimization methods are used. It gives the brief explanation about the multiple view in the geometric planes using the computer vision.

In existing use the VCR and GPSR method. In Greedy Perimeter Stateless Routing (GPSR) makes greedy forwarding decisions until it fails, for example due to a geographical void, and attempts to recover by routing around the perimeter of the void. VC-based schemes, where each node is characterized by a coordinate vector corresponding to hop distances to a set of anchors, uses a distance measure in VCS to identify the node for packet forwarding. When a packet reaches a local minima, an expanding ring search is performed until a closer node is found or time to live (TTL) expires. To avoid this drawbacks this project proposed TPM. A novel and a fundamental technique for generating TPMs from VCs for 2-D and 3-D (both surface and volume) WSNs. TPMs may be used in lieu of physical maps for many applications and WSN protocols. TPM presents a robust, accurate, and scalable alternative to physical map generation or localization. The following chapter shows the methods and results of the proposed system.

3. Methodology:

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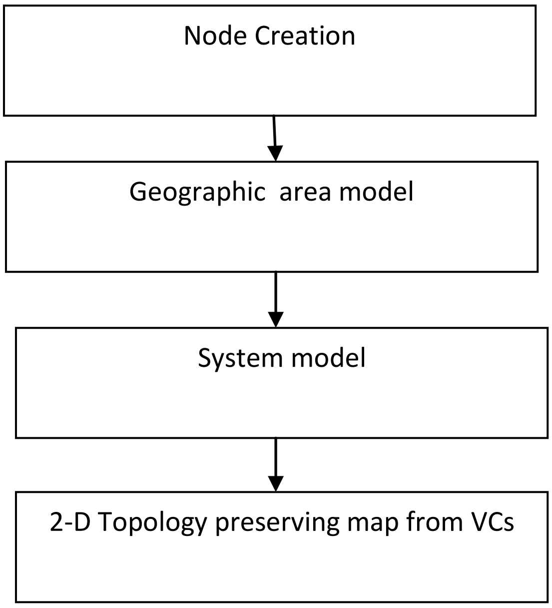
3.1 System Architecture:



3.2 Modules

3.2.1. Node Creation:

A node network is a series of two or more connected nodes. Once a connection between two or more nodes has been defined, all searches produce listings of configured users and resources from both local and remote nodes. This basic information is maintained on each computer in the node network. All calendaring data for each user and resource, however, resides only on that entity's local node, thus eliminating the space and consistency problems created by replicated databases. All exchanges of this information between nodes are done in real-time, making the scheduling of meetings with people or resources on remote nodes completely transparent to the user. When setting up a node it is important to note that the node-ID cannot be changed once the node has been created. The node can be created with its node type, size and properties. Created node can be located in the network.

3.2.2. Geographic area Model:

This model tries to realize division of geographical area in the form of cluster (sub-area) with higher node density and paths in between lower node density. The cluster is recognize as a vertices of the area graph while path as edges. The movement of cluster node could be managed with random way point model. An energy-aware key distribution scheme, which uses geographical location information.

3.2.3. System Model Generation:

Modeling network behavior in a WSN is crucial because many important performance values are based on the network. The topology of WSN systems can be dynamic or static. The static topology represents the nodes in a fixed location while the dynamic topology represents the nodes while they are in a moving state. The topology is modeled as a grid location. Each node location is modeled as an X-Y variable.

3.2.4. 2-D Topology Preserving Maps From VCs

Consider a 2-D sensor network with N nodes and M anchors. Thus, each node is characterized by a VC vector of length M . Let p be the NXM matrix containing the VCs of all the nodes.

$$P = |h_{n_i A_j}|$$

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The main goal thus is to extract the 2-D representation of the network from this M-D space.

$$P = U \cdot S \cdot V^T$$

Let us consider the principle components (PCs) of p

$$P_{\mathrm{SVD}} = U \cdot S.$$

The set of VCs has the connectivity information embedded in it, though it has no directional information Cartesian coordinates for plotting an approximate map of the network, i.e.,

$$[X_T, Y_T] = [P_{\mathrm{SVD}}^{(2)}, P_{\mathrm{SVD}}^{(3)}]$$

These Cartesian coordinates are estimated without having any kind of physical directional or positioning information beyond the radial information (hop distance) with respect to the anchors. Results presented later demonstrate that a TPM thus obtained preserves the topological characteristics of the original network. One can even identify features such as physical voids that were not apparent in the VC-based description.

4. Results:

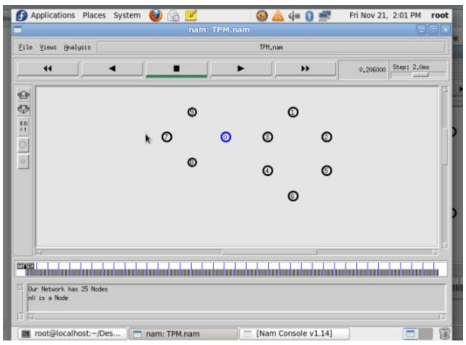

Fig: 4.1 Node Creation

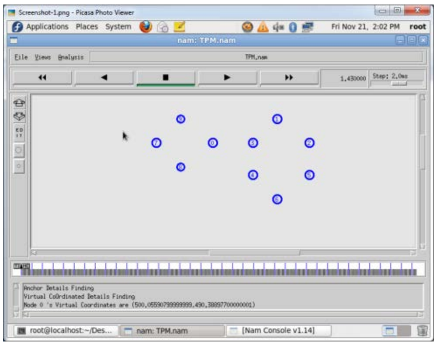

Fig: 4.2 Anchor details Finding

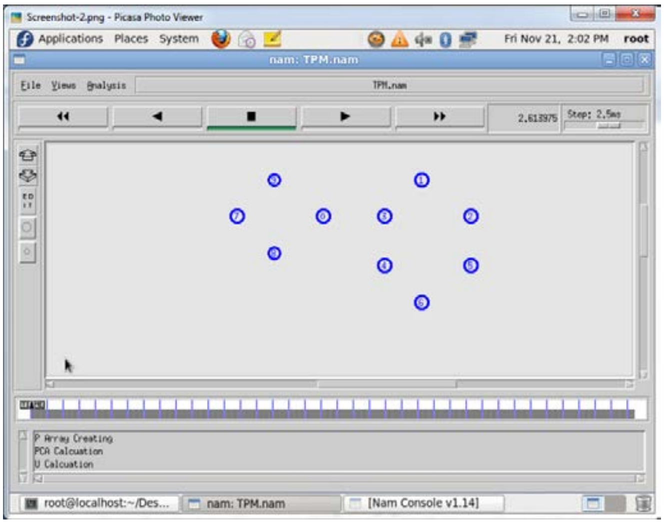

Fig: 4.3 PCA Calculations

5. Conclusion

This project proposed extract topology-preserving maps (TPMs) layout from virtual coordinates (VCs) of wireless sensor networks. Virtual coordinates (VCs) are provided an economical alternative to geographical coordinates for routing and self organization of large-scale wireless sensor networks (WSNs). This project proposed the TPM from the virtual co-ordinates. In a virtual coordinate system (VCS) a node is identified by a vector containing its distances, in hops to a small subset of nodes called anchors. And extract the virtual co-ordinates. Topology coordinates provide an economical

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