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Mobile Ad-Hoc Disaster Management Using Cardinal Location Transmitting Sensor Embedded Device

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Abstract: *Communication systems in the managing of disaster relief operations are critical. The wi-fi structures are anticipated to carry out at their first-class in opposed conditions with confined resources considering the fact that lots of lives are at stake. past tragedies like tsunami, assaults, hurricane have highlighted the extreme flaws in the present information/communication exchange structures. In reaction to those tragedies, researchers are arising with higher solutions for wi-fi networks. on this paper, we propose a new routing protocol (Local Resection of Exposure Nodes Over Highly Dynamic Vector) for cardinal location transmitting sensor embedded mobile devices, it supports highly for fault tolerance and to avoid route breaks and to fast reestablishes a new route before a route break and recovery of fault based on direction and location, to improve the quality of service over minimize the complexity of routing and highly support for fault analysis, speed of service, increased intelligence of tracking devices and speed recovery of fault over communication failures like link breakage and fast relocation. The scope of this paper is to offer an best technology in disaster relief operations over mobile ad-hoc devices. Subsequent, some currently being carried out for disaster remedy operations are analyzed and finally, various wireless applications which might be in use are discussed.*
Keywords: *disaster management, cardinal location, sensor networks, magnetometer, LRDV, localization*

I. Introduction

The advent of modern science and technology had focused researchers towards wireless network technologies towards emergency response situations where critical disaster condition occurs. Many of the researchers had focused their research towards different protocols and schemes for disaster management, the proposed LRDV is based on the modern devices; it can locally resection the disaster area between the devices and the direction and location of each devices is known each other; so the devices can communicate based on location in a timely manner. The major focus of this research moves towards deployment of cost effective wireless ad hoc sensor networks with sensor nodes based tag devices which are capable to transmit disaster effected condition to nearby Ad hoc Relay Stations with in adjacent area for rescues operation and in trace of route discovery specially for the people which are trapped beneath rubble. There has been great amount of work done by researchers on Clustering Scheme and data Routing techniques where multiple clusters are composed of sensor nodes that are coordinating with each head node within each cell are responsible for transmitting the disaster affected conditions to Ad hoc Relay stations or Base Stations to rescue the disaster effected people in critical circumstances.

fig.1: disaster area

The proposed architecture has also been proposed for data dissemination and localization of effected people/devices. One of the major strength of this research focuses on location management issues related to particular sensor node. The embedded sensor node is capable to detect location and direction during communication, particularly designed for emergency rescue operations after the disaster. The route establishment algorithm proposed is responsible for route establishment process of particular neighboring node in a network/disaster area[12][13][14].

II. Objective

Objective of this research work is, Resection/Localize the MANET devices using smart sensors, reduce the bottleneck of the routing and effective fault tolerance protocol during the disaster.

1. We consider the problem of locating and orienting a ad-hoc network of unattended sensor nodes that have been deployed in a scene at unknown locations especially very complex in disaster area.
2. Localization is a fundamental task in wireless ad-hoc networks.
3. In a location related system, the acquisition of objects' locations is the critical step for the effective and smooth working procedures.
4. The basic concept is to use a large number of magnetic sensor embedded nodes/devices of the ad-hoc/modern network.

III. LRDV Vs. Disaster Management

Location control is one of the maximum vital trouble in providing actual-time programs over ad-hoc networks due to its mobility and impact to first-class of service (QoS), for the reason that mobility brings freedom and accelerated productiveness to various packages and organizations in the smart global; it also reasons challenges for the enterprise and so on. LRDEV can deal with all the above problems in a easy manner through the usage of our clever mobility devices using an adaptive place significance grid protocol. Proposed area-tracking approach is derived with the cooperation of magnetometer sensors embedded. each time a brand new node is detected, it'll be added to the digital grid plane, on which the routing protocols could be initiated to statistics transfer. all of the verbal exchange system going out to the node will bypass the digital 3-D Grid.

1. 3D Plan Virtual Grid

We consider a smart phone magnetometer sensor network, Compasses are typically mounted on an object that the user wants to monitor the direction of, and most of the smartphones were equipped with a magnetometer that measures the local magnetic field in three dimensions, usually built out of two or three magnetic field sensors that provide data for a microprocessor. All the magnetometer sensor nodes inputs were placed in a 3D plane. Sensors input will be arranged as an irregular network, as shown in Fig. 1. In order to track objects' routes, each sensor is aware of its physical location as well as the physical locations of its neighboring sensors. Each sensor has sensing capability as well as computing and communication capabilities, so as to execute protocols and exchange messages. Each sensor is able to detect the existence of nearby moving objects. All the nodes will be maintained in a virtual grid to maintain the location and choosing the shortest path.

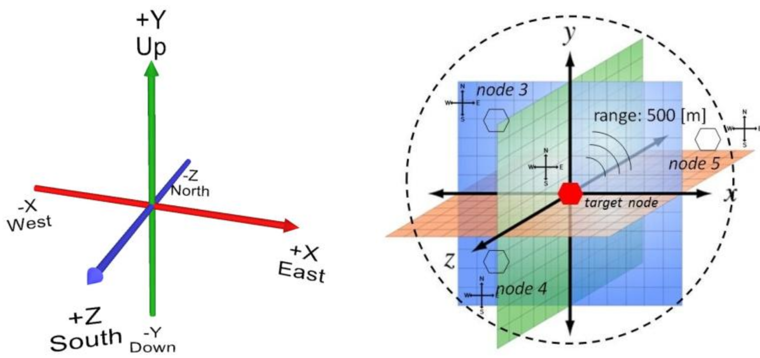

fig.1: 3d plane - 3d grid/array

A nodes orientation can be worked out by combining data from the magnetometer and its accelerometer, which detects how the phone's orientation has moved relative to a baseline reference position. A magnetometer embedded nodes that are used to determine direction relative to the surface of the earth. Compasses measure direction with respect to the 4 cardinal directions (North, East, South, and West) with 0 degrees indicating straight North and 180 degrees indicating straight South.

2. Magnetometer and Virtual Grid

The Virtual grid is made for each device according to the communable strength. By using the magnetometer field value we can able to get the direction (magnitude say device X), Then the logic of retrieval speed says the distance of the other-end communication device (say Distance di). Then the virtual grid will list all near by devices to a 3 dimensional space based on the range to communicate effectively over the network[10].

fig 2: tiny smartphone magenetometer

Magenetometer Properties:

1. Many Smartphone's now have a 3-axis magnetometer included. Sensor that detects the Earth's magnetic field along three perpendicular axes X, Y and Z.
2. The magnetometer is enclosed in a small electronic chip that often incorporate another sensor (typically a built in accelerometer) that help to correct the raw magnetic measurements using tilt information from the auxiliary sensor.
3. In addition to general rotational information, the magnetometer is crucial for detecting the relative orientation of your device relative to the Earth's magnetic north.
4. The magnetometer readings are reported in micro Tesla units (μT).
5. They detect the Earth's magnetic field and respond to it.
6. Detect the field as opposed to a small magnet.
7. This will be more accurate and allows to respond more quickly to changes in direction.
8. Able to trace the most common relative directions are left, right, forward(s), backward(s), up, and down.

Using this direction the device movement and the routing can be done perfectly, a blind broadcast can be stopped, able to serve the nearby node based on the direction.

3. Routing

The main goal of an ad hoc network routing algorithm is to correctly and efficiently establish a route between a pair of nodes in the network so a message can be delivered according to the expected QoS parameters. The establishment of a route should be done with minimum overhead and bandwidth consumption. In the current wired networks, there are different link states and distance vector routing protocols, which were not designed to cope with constant topology changes of mobile ad hoc environments. Link-state protocols update their global state by broadcasting their local state to every other node, whereas distance-vector protocols exchange their local state to adjacent nodes only. Their direct application to a MANET may lead to undesired problems such as routing loops and excessive traffic due to the exchange of control messages during route establishment. An ad hoc network has a dynamic nature that leads to constant changes in its network topology. As a consequence, the routing problem becomes more complex and challengeable, and it probably is the most addressed and studied problem in ad hoc networks. This reflects the large number of different routing algorithms for MANETs proposed in the literature.

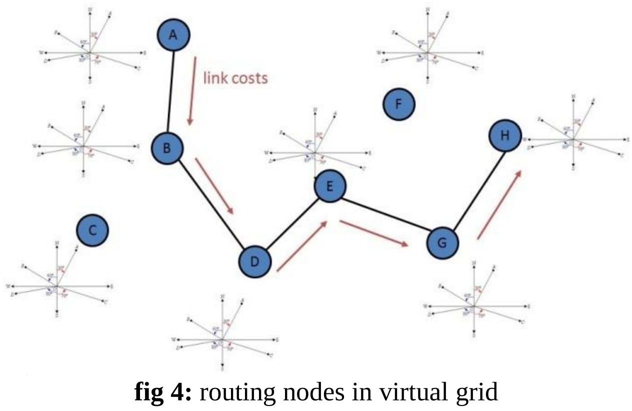

fig 4: routing nodes in virtual grid

Ideally, a routing algorithm for an ad hoc network should not only have the general characteristics of any routing protocol but also consider the specific characteristics of a mobile environment—in particular, bandwidth and energy limitations and mobility. Some of the characteristics are: fast route convergence; scalability; QoS support; power, bandwidth, and computing efficient with minimum overhead; reliability; and security. Usually the protocols will use the routing tables to identify the nodes, but using the Virtual Grid the node can able to select the service path to transmit the next level data, so by the virtual grid both the routing table and the location management get combined and reduces the service time[4][5][8].

4. Route Discovery

There are two phases: Route Discovery and Route Maintenance.

- Each node maintains a routing table with knowledge about the network.
- LRDV deals with route table management, routing table won't get overloaded.
- LRDV minimizes the number of broadcasts , since Routing is direction oriented
- Based on the neighbor servicing quadrant direction the service node selection will be selected
- Load balanced
- Local Resection of routing nodes is made internally based on the direction and distance, by nature inside the table.

5. LRDV Routing Protocol

- There are two phases
  - Route Discovery.
  - Route Maintenance.
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4.1 LRDV Route Discovery Example

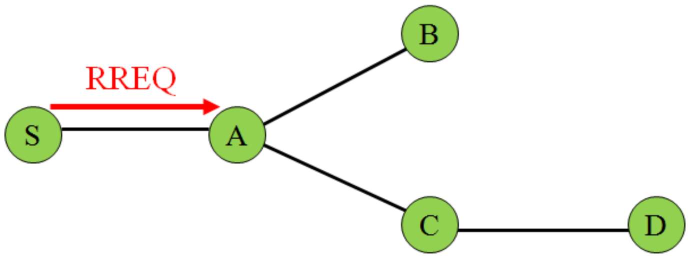


fig 5: routing nodes discovery

Node S needs a route in order to send data packet to D

1. It creates a Route Request (RREQ) along with:
   – D's IP addr, last known D's seq#.
   – S's IP addr, new S's seq#.
   – hopcount (=0).
2. It broadcasts RREQ (Route Request Packet) to its neighbors
3. Node A receives RREQ
   – Makes reverse route entry for S
   – It has no route to D, so it continue to broadcast the RREQ

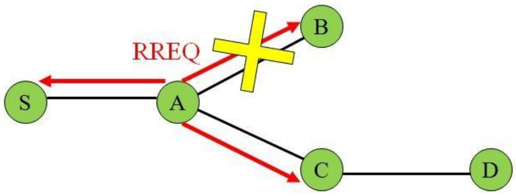
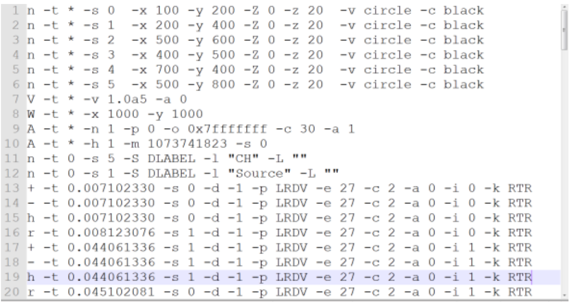


fig 6: routing nodes selection based on direction from 3d grid

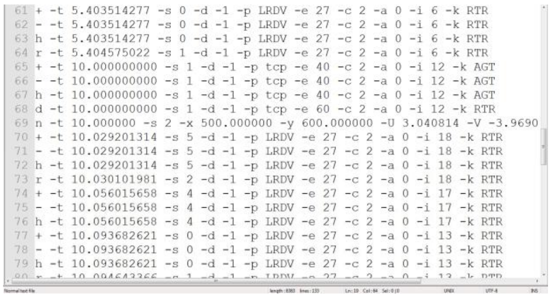
The RREQ is broadcast to nodes C and not to B since the routing is directing oriented; node C receives RREQ and finally it reaches D

IV. Result And Discussion

Simulation using Network Simulator (NS-2) (Fig.6, Fig.7, Fig.8) shows that enriched LRDV Protocol uni-cast the message to the other nodes. The simulations use 6 nodes (pause time 0, 20, 40, 100 seconds) and 4 different traffic patterns (5, 10, 15, and 20 sources) and uses the Channel type is "WirelessChannel", radio propogagion model: "Propagation/TwoRayGround", network interface type: "wireless", MAC type: "Mac/802_11", interface queue type: "CMUPriQueue" ; link layer type: "LL", antenna model : "Antenna/OmniAntenna", maximum packet: 50, 1000x1000; dimension of topography.



```
n -t * -s 0  -x 100 -y 200 -Z 0 -z 20  -v circle -c black
n -t * -s 1  -x 200 -y 400 -Z 0 -z 20  -v circle -c black
n -t * -s 2  -x 500 -y 600 -Z 0 -z 20  -v circle -c black
n -t * -s 3  -x 400 -y 500 -Z 0 -z 20  -v circle -c black
n -t * -s 4  -x 700 -y 400 -Z 0 -z 20  -v circle -c black
n -t * -s 5  -x 500 -y 800 -Z 0 -z 20  -v circle -c black
V -t * -v 1.0a5 -a 0
W -t * -x 1000 -y 1000
A -t * -n 1 -p 0 -o 0x7fffffff -c 30 -a 1
A -t * -h 1 -m 1073741823 -s 0
n -t 0 -s 5 -S DLABEL -l "CH" -L ""
n -t 0 -s 1 -S DLABEL -l "Source" -L ""
+ -t 0.007102330 -s 0 -d -1 -p LRDV -e 27 -c 2 -a 0 -i 0 -k RTR
- -t 0.007102330 -s 0 -d -1 -p LRDV -e 27 -c 2 -a 0 -i 0 -k RTR
h -t 0.007102330 -s 0 -d -1 -p LRDV -e 27 -c 2 -a 0 -i 0 -k RTR
r -t 0.008123076 -s 1 -d -1 -p LRDV -e 27 -c 2 -a 0 -i 0 -k RTR
+ -t 0.044061336 -s 1 -d -1 -p LRDV -e 27 -c 2 -a 0 -i 1 -k RTR
- -t 0.044061336 -s 1 -d -1 -p LRDV -e 27 -c 2 -a 0 -i 1 -k RTR
h -t 0.044061336 -s 1 -d -1 -p LRDV -e 27 -c 2 -a 0 -i 1 -k RTR
r -t 0.045102081 -s 0 -d -1 -p LRDV -e 27 -c 2 -a 0 -i 1 -k RTR
```



```
+ -t 5.403514277 -s 0 -d -1 -p LRDV -e 27 -c 2 -a 0 -i 6 -k RTR
- -t 5.403514277 -s 0 -d -1 -p LRDV -e 27 -c 2 -a 0 -i 6 -k RTR
h -t 5.403514277 -s 0 -d -1 -p LRDV -e 27 -c 2 -a 0 -i 6 -k RTR
r -t 5.404575022 -s 1 -d -1 -p LRDV -e 27 -c 2 -a 0 -i 6 -k RTR
+ -t 10.000000000 -s 1 -d -1 -p tcp -e 40 -c 2 -a 0 -i 12 -k AGT
- -t 10.000000000 -s 1 -d -1 -p tcp -e 40 -c 2 -a 0 -i 12 -k AGT
h -t 10.000000000 -s 1 -d -1 -p tcp -e 40 -c 2 -a 0 -i 12 -k AGT
d -t 10.000000000 -s 1 -d -1 -p tcp -e 60 -c 2 -a 0 -i 12 -k RTR
n -t 10.000000 -s 2 -x 500.000000 -y 600.000000 -U 3.040814 -V -3.9690
+ -t 10.029201314 -s 5 -d -1 -p LRDV -e 27 -c 2 -a 0 -i 18 -k RTR
- -t 10.029201314 -s 5 -d -1 -p LRDV -e 27 -c 2 -a 0 -i 18 -k RTR
h -t 10.029201314 -s 5 -d -1 -p LRDV -e 27 -c 2 -a 0 -i 18 -k RTR
r -t 10.030101981 -s 2 -d -1 -p LRDV -e 27 -c 2 -a 0 -i 18 -k RTR
+ -t 10.056015658 -s 4 -d -1 -p LRDV -e 27 -c 2 -a 0 -i 17 -k RTR
- -t 10.056015658 -s 4 -d -1 -p LRDV -e 27 -c 2 -a 0 -i 17 -k RTR
h -t 10.056015658 -s 4 -d -1 -p LRDV -e 27 -c 2 -a 0 -i 17 -k RTR
+ -t 10.093682621 -s 0 -d -1 -p LRDV -e 27 -c 2 -a 0 -i 13 -k RTR
- -t 10.093682621 -s 0 -d -1 -p LRDV -e 27 -c 2 -a 0 -i 13 -k RTR
h -t 10.093682621 -s 0 -d -1 -p LRDV -e 27 -c 2 -a 0 -i 13 -k RTR
```

Fig 6: 3D Location Trace

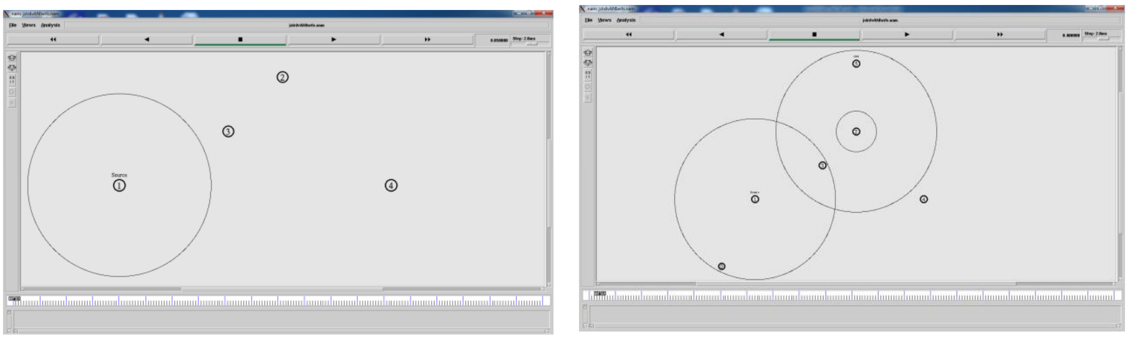


Fig 8: 3D Location Trace

V. Conclusion

In this paper, we initiate the study of location management in wireless ad hoc network/disaster management to improve the routing with the aim of achieving good performance in terms of QoS. In addition, our algorithm is local and deals with dynamic change efficiently. The outcomes of the research study focuses on location management among the mobile ad-hoc network in disaster area revels the successive results of routing and broadcast. Most of the methods are adopted with various sensors deployed on the locations, position identifying happens among those areas and use less for general purpose among the mobile ad-hoc devices. The proposed methodology along with the magnetometer hops a successive model among the emerging mobile ad-hoc network location management effectively. The advantages of this methodology will improve the quality of services, minimize the complexity of routing, highly support for fault analysis, clustering, speed of service, increased intelligence of tracking devices, speed recovery of fault over communication failures like link breakage and fast relocation. Also we presented a virtual grid based shortest path routing. Since the virtual grid plane consists of all nodes, the shortest path algorithm is applied over it and the shortest path is getting selected. Our study shows that result of the LRDV routing protocol is highly useful for disaster area for routing and locating nodes effectively.

- Advantages
  - Simple balanced load
  - Vector based routing
  - Fault tolerant based
  - Direction based and load balanced highly helpful for disaster area to locate and transmit nodes
- Disadvantages
  - Entire routing table not get stored under one node

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