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A Survey on MANETs in Disaster Rescue Operations

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Abstract: ***Wireless ad hoc networks have become an important area of research in wire-less communications systems.When beaten by a drastic natural disaster, emergency rescue operation is very critical to save many lives. Many people stricken in the disastrous areas under collapsed buildings or landslides may have a large chance to survive if they are rescued in "Golden 72 Hours". Victims rescued from volunteers and NDMA soldiers. In order to give effective rescue operations the rescue teams needs to communicate in effective and efficient ways. In our paper we presented the techniques and algorithms followed by different people to provide effective communication in terms of power management, routing protocols, QoS parameters***

Keywords: ADHOC NETWORKS, DISASTER, QOS

1. Introduction

When a disaster occurs it becomes difficult to provide services in the affected areas due to the lack of communication. All modes of communication system get damaged and it takes a lot of time to establish an infrastructure network. To overcome this the infrastructure less Mobile Adhoc network is established using Wi-Fi enabled devices for effective and efficient rescue operations. In this paper we have presented the survey on MANET protocols for effective communication between rescue teams and team members for successful completion of the operation within golden hours. However, Multi hop communication needed if the distance is more than 30m.

2. Literature Survey

Srivastava [1] in his work, they have considered that rescue team can be operated at three stages after hitting the disaster in particular location. The three stages are 1) disaster core location 2) first aid treatment centre and hospital 3)ambulance as a link between them. These three stages can be communicated by using MANET network. The Mobility of MANET nodes between the three stages maintained with Reference point group mobility (RPGM) based on level of attraction.

Performance of ad hoc network is analyzed for three routing protocols such as reactive (AODV), proactive (OLSR) and hybrid (ZRP) protocols.In this framework they explore this model and routing of nodes based on attraction and level of danger, layer to layer. They have taken mobile nodes to each and every layer because its need in every stage. Due to the problems and complexity of mobility they left the moving node problem for future work.

Takaaki Umedu [2] proposes and evaluates a MANET system to perform rescue operation and maintain the location and personal information of victims in disaster hitting area where fixed network infrastructure is not possible. This methodcollects the information from terminals with GPS receivers using ad-hoc based communicationthrough terminals and vehicles. Here terminals are victims and vehicles are ambulances. In this system, the disasteraffected area is divided into grids and thedata will be cooperatively stored and shared by the mobile terminalsin each area. If the capacity to store the data in anarea is not enough, a part of the data will be relocatedto neighbor areas.In their work they have proposed a flooding based routing protocol for communication between vehicles called RMDP (Received Message Dependent Protocol). In RMDP, the transmission time interval is adjusted according to the number of received messages and detected collision errors in order to satisfy stable data exchange. But RMDP is aimed for distribution of road information collected by vehicles even without any direction. For this reason the modified RMDP is proposed for directed flooding.

Guangyu Pei [3] proposed an ad hoc communication model based on group mobility. Each group has a their own motion behavior, with some random deviation plus its previous motion. Nodes in the group follow the group moving policy with the same function as the group, and customized parameters. This model requires a some space for each node. In their paper, they introduce a new group mobility model. Nodes are categorized into groups based on their logical relationship. There will be a center node for every group. Centre's location, speed, and direction can be considered as groups parameters. The every group is used predefined group motion policy. Therandom-walk, or a target oriented path are considered for predefine policies. In this hierarchical routing scheme given solution for group overlap subnet.

Hung-Chin Jang [4]have considered and elaborate on the Rescue Information System for Earthquake Disasters (RISED), which is designed to support a more efficient rescue and relief operation formajor earthquake disasters. The disaster location may lost its connection to the outside world due to different reasons. The main objective of thisscheme is to provide the latest and accurate such as possible damages toconstructions and lives,disaster locations, the best and shortest way to the disaster area etc. The scheme RISED isoperated independently in two ways.

They are central RISED and local RISED. The disaster area may not have connection with outside world. In this position the local RISED scheme can operate independently and provide information to rescue teams. As a fortunate if connection is established then both central and local schemes scan share to provide latest information.

Nils Aschenbruck[5] In their work they present a scheme for mobility management in MANETs. While the group or MANET is moving it is difficult to get information from the nodes. In this model they have evaluated the network performance while it is moving and compared with basic mobility models such as Gauss-Markov model and random walk policy. The mobility management plays a vital role in the construction of MANETs as well as in rescue operations. They have considered a few mobility parameters such as relative mobility, average node degree, the average link duration and minimum no. of links maintained between one node and its neighbors.

In 1998, Bambos [6] reviewed developments in power control in wireless networks and identifiedthe need for minimum-power routing protocols. Power management in wireless networks is attractable research area. This power management deals with all layers of the network. This fact is motivated by the fact wireless devices needs a small amount of power usually. In network layer power aware routing protocols are to be suggested. In the same way different protocols are required for power management in all of the layers.

In order to reviewing the power aware routing algorithms the some of them are stated here. In[7] an energy efficient routing algorithm was proposed and evaluated by using simulations. In [8] some power aware metrics are considered and evaluates the network performance. Some of the routing protocols in MANETs focused on performance comparisons foe adhoc routing algorithms.

Gil Zussman[11]proposed to enable the formation of a network composed of smart badges in order to acquire information from survivors of structural collapse. The two main aspects that affect the performance of such a network are the limited batteries of the badges and their very low data rates (relatively to the requirements in a disaster scene). Accordingly, an energy efficient routing problem in such a network has been formulated as any cast routing problem. The problem has been formulated such that the objective function is to maximize the time until the first battery drains-out and the flow through the badges is bounded by their data rates. Finally, we note that despite the theoretical importance of the optimal algorithms and bounds, in an emergency situation there is a need for low complexity heuristic algorithms.

Thus, a major future research direction is the development of approximate and heuristic algorithms that will deal with the special characteristics of a smart badges network operated in a disaster site.

3. Discussions

The disaster rescue teams are required to communicate in an efficient manner to save people from their critical situation. The efficient communicationneeds different techniques and algorithms. In order to give best solutions for many people stated many solutions but still some more problems are there. As stated above for MANETs a huge amount of solutions were proposed but a few of them are considered for survey of my research. In a paper[1] they proposed a solution for group mobility model based on the attraction level of the network or nodes. Still this group mobility model requires some more better solutions to improve its quality of service(QoS). The papers [7][8][9][10] some of the solutions for power management. They given better solutions for energy efficient routing, power aware routing, power aware enhancements and reducing energy consumption by the nodes in the network. In the context of power management it plays a major role in rescue operations and it needs some more enhancements. All the routing algorithms are evaluated and finally decide that best routing schemes are to be found for the improvement of quality of service in the network.

In the paper [2] the flooding based routing algorithm is proposed. This can be used for inter vehicle communication in the rescue operation. This paper contributes for the improvement of routing conditions but still it requires some more enhancements on flooding based routing protocols for best QoS. The paper [4] stated an algorithm for only earthquakes to find the locations and to estimate the effect of earthquake. This is also one of the considerable areas for the research. The papers [3][4] are the solutions for group based mobility and motion policies and the extended their work for better satisfaction but still it needs a best solutions for group based mobility.

4. Conclusion

The golden 72 hours should be utilized in a proper way to serve better to the victims of disasters. This utilization is possible when the best policies can be used by the rescue teams in terms of communications. In this paper we stated some of the solutions in MANETs for rescue operations to serve better. This paper having discussions on routing solutions, group mobility, power management and network architectures. With respect to the above discussions the future work may leads to improve the QoS for the network conditions and network architectures.

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