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Wireless Ad Hoc Networks in Opportunistic Routing With Congestion Diversity


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ABSTRACT:

We consider the problem of routing packets across a multi-hop network consisting of multiple sources of traffic and wireless links while ensuring bounded expected delay. Each packet transmission can be overheard by a random subset of receiver nodes among which the next relay is selected opportunistically. The main challenge in the design of minimum-delay routing policies is balancing the trade-off between routing the packets along the shortest paths to the destination and distributing the traffic according to the maximum backpressure. Combining important aspects of shortest path and backpressure routing, this paper provides a systematic development of a distributed opportunistic routing policy with congestion diversity (D-ORCD). D-ORCD uses a measure of draining time to opportunistically identify and route packets along the paths with an expected low overall congestion. D-ORCD with single destination is proved to ensure a bounded expected delay for all networks and under any admissible traffic, so long as the rate of computations is sufficiently fast relative to traffic statistics.

Furthermore, this paper proposes a practical implementation of D-ORCD which empirically optimizes critical algorithm parameters and their effects on delay as well as protocol overhead. Realistic QualNet simulations for 802.11-based networks demonstrate a significant improvement in the average delay over comparable solutions in the literature.

EXISTING SYSTEM:

- The opportunistic routing schemes can potentially cause severe congestion and unbounded delay. In contrast, it is known that an opportunistic variant of backpressure, diversity backpressure routing (DIVBAR) ensures bounded expected total backlog for all stabilizable arrival rates. To ensure throughput optimality (bounded expected total backlog for all stabilizable arrival rates), backpressure-based algorithms do something very different: rather than using any metric of closeness (or cost) to the destination, they choose the receiver with the largest positive differential backlog (routing responsibility is retained by the transmitter if no such receiver exists).
- E-DIVBAR is proposed: when choosing the next relay among the set of potential forwarders, E-DIVBAR considers the sum of the differential backlog and the expected hop-count to the destination (also known as ETX).

DISADVANTAGES OF EXISTING SYSTEM:

- The existing property of ignoring the cost to the destination, however, becomes the bane of this approach, leading to poor delay performance in low to moderate traffic.
- Other existing provably throughput optimal routing policies distribute the traffic locally in a

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manner similar to DIVBAR and hence, result in large delay.

- ❖ E-DIVBAR does not necessarily result in a better delay performance than DIVBAR.

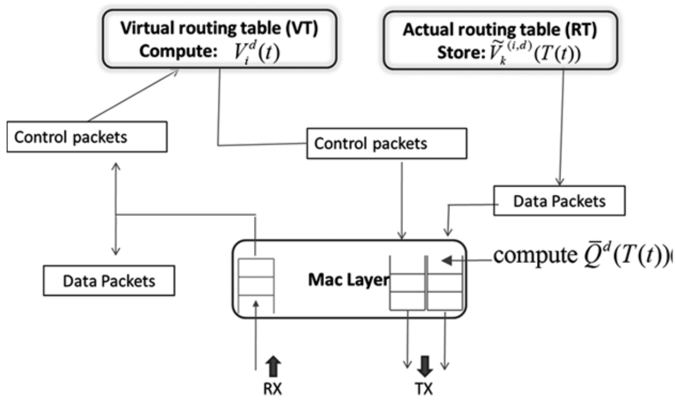
PROPOSED SYSTEM:

- ❖ The main contribution of this paper is to provide a distributed opportunistic routing policy with congestion diversity (D-ORCD) under which, instead of a simple addition used in E-DIVBAR, the congestion information is integrated with the distributed shortest path computations .
- ❖ A comprehensive investigation of the performance of D-ORCD is provided in two directions:
- ❖ We provide detailed simulation study of delay performance of D-ORCD. We also tackle some of the system-level issues observed in realistic settings via detailed simulations.
- ❖ In addition to the simulation studies, we prove that D-ORCD is throughput optimal when there is a single destination (single commodity) and the network operates in stationary regime. While characterizing delay performance is often not analytically tractable, many variants of backpressure algorithm are known to achieve throughput optimality.

ADVANTAGES OF PROPOSED SYSTEM:

- ❖ We show that D-ORCD exhibits better delay performance than state-of-the-art routing policies with similar complexity, namely, ExOR, DIVBAR, and E-DIVBAR. We also show that the relative performance improvement over existing solutions, in general, depends on the network topology but is often significant in practice, where perfectly symmetric network deployment and traffic conditions are uncommon.
- ❖ We show that a similar analytic guarantee can be obtained regarding the throughput optimality of D-ORCD. In particular, we prove the throughput optimality of D-ORCD by looking at the convergence of D-ORCD to a centralized version of the algorithm. The optimality of the centralized solution is established via a class of Lyapunov functions proposed.

SYSTEM ARCHITECTURE:



MODULES:

- ❖ System Formation
- ❖ Congestion Measure
- ❖ Link Quality Estimation Protocol
- ❖ Opportunistic Routing With Partial Diversity

MODULES DESCSRIPTION:

System Formation

- ❖ In this module, first we develop the System Formation concepts. We consider a network of D nodes labeled by Ω= {1,….,D} . We characterize the behavior of the wireless channel using a probabilistic transmission model. Node is said to be neighbor of node , if there is a positive probability p_{ij} that a transmission at node i is received at node . The set of all nodes in the network which are reachable by node is referred to as neighborhoodof node.
- ❖ D-ORCD relies on a routing table at each node to determine the next best hop. The routing table at node consists of a list of neighbors and a structure consisting of estimated congestion measure for all neighbors in associated with different destinations.
- ❖ The routing table acts as a storage and decision component at the routing layer. The routing

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table is updated using a "virtual routing table" at the end of every "computation cycle": an interval of units of time.

- To update virtual routing table, during the progression of the computation cycle the nodes exchange and compute the temporary congestion measures.

Congestion Measure

- In this module, we develop the proposed system by this the system can able to identify the Congestion happened. The Congestion measure values are code and defined in the module.
- The congestion measure associated with node for a destination at time is the aggregate sum of the local draining time at node and the draining time from its next hop to the destination. D-ORCD computes the expected congestion measure "down the stream".
- The implementation of D-ORCD, analogous to any opportunistic routing scheme, involves the selection of a relay node among the candidate set of nodes that have received and acknowledged a packet successfully. One of the major challenges in the implementation of an opportunistic routing algorithm, in general, and D-ORCD in particular, is the design of an 802.11 compatible acknowledgement mechanism at the MAC layer.

Link Quality Estimation Protocol

- In this module we develop the Link Quality Estimation Protocol for the proposed system model. D-ORCD computations given by (1) utilize link success probabilities p_{ij} for each pair of nodes i,j. We now describe a method to determine the probability of successfully receiving a data packet for each pair of nodes.
- Our method consists of two components: active probing and passive probing.
- In the active probing, dedicated probe packets are broadcasted periodically to estimate link success probabilities.
- In passive probing, the overhearing capability of the wireless medium are utilized. The nodes are configured to promiscuous mode, hence enabling them to hear the packets from neighbors. In passive probing, the MAC layer keeps track of the number of packets received from the neighbors including the retransmissions.
- Finally, a weighted average is used to combine the active and passive estimates to determine the link success probabilities. Passive probing does not introduce any additional overhead cost but can be slow, while active probing rate is set independently of the data rate but introduces costly overhead.

Opportunistic Routing With Partial Diversity

- In the module, the opportunistic Routing part is implemented and developed in the proposed system model. The three-way handshake procedure achieves opportunism and receiver diversity gain at the cost of an increased feedback overhead. In particular, it is easy to see that this overhead cost, i.e., the total number of ACKs sent per data packet transmission, increases linearly with the size of the set of potential forwarders. Thus, we consider a modification of D-ORCD in the form of opportunistically routing with partial diversity (PD-ORCD).
- This class of routing policies is parametrized by a parameter denoting the maximum number of forwarder nodes: the maximum number of nodes allowed to send acknowledgment per data packet transmission is constrained to be no more than . Such a constraint will sacrifice the diversity gain, and hence the performance of any opportunistic routing policy, in favor of lowering overhead cost.
- In order to implement opportunistic routing policies with partial diversity, before the transmission stage occurs, we find the set of "best neighbors" for each node

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INPUT DESIGN AND OUTPUT DESIGN

INPUT DESIGN

The input design is the link between the information system and the user. It comprises the developing specification and procedures for data preparation and those steps are necessary to put transaction data in to a usable form for processing can be achieved by inspecting the computer to read data from a written or printed document or it can occur by having people keying the data directly into the system. The design of input focuses on controlling the amount of input required, controlling the errors, avoiding delay, avoiding extra steps and keeping the process simple. The input is designed in such a way so that it provides security and ease of use with retaining the privacy. Input Design considered the following things:

- What data should be given as input?
- How the data should be arranged or coded?
- The dialog to guide the operating personnel in providing input.
- Methods for preparing input validations and steps to follow when error occur.

OBJECTIVES

1. Input Design is the process of converting a user-oriented description of the input into a computer-based system. This design is important to avoid errors in the data input process and show the correct direction to the management for getting correct information from the computerized system.

2.It is achieved by creating user-friendly screens for the data entry to handle large volume of data. The goal of designing input is to make data entry easier and to be free from errors. The data entry screen is designed in such a way that all the data manipulates can be performed. It also provides record viewing facilities.

3. When the data is entered it will check for its validity. Data can be entered with the help of screens. Appropriate messages are provided as when needed so that the user will not be in maize of instant. Thus the objective of input design is to create an input layout that is easy to follow

OUTPUT DESIGN

A quality output is one, which meets the requirements of the end user and presents the information clearly. In any system results of processing are communicated to the users and to other system through outputs. In output design it is determined how the information is to be displaced for immediate need and also the hard copy output. It is the most important and direct source information to the user. Efficient and intelligent output design improves the system's relationship to help user decision-making.

1. Designing computer output should proceed in an organized, well thought out manner; the right output must be developed while ensuring that each output element is designed so that people will find the system can use easily and effectively. When analysis design computer output, they should Identify the specific output that is needed to meet the requirements.

2. Select methods for presenting information.

3. Create document, report, or other formats that contain information produced by the system.

The output form of an information system should accomplish one or more of the following objectives.

- Convey information about past activities, current status or projections of the
- Future.
- Signal important events, opportunities, problems, or warnings.
- Trigger an action.
- Confirm an action.

IMPLEMENTATION

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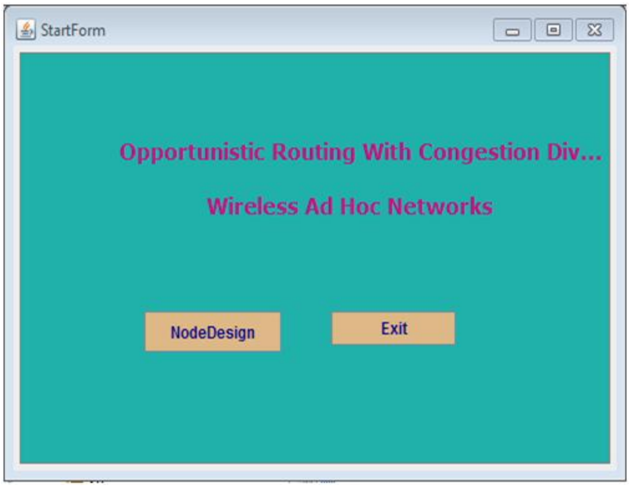
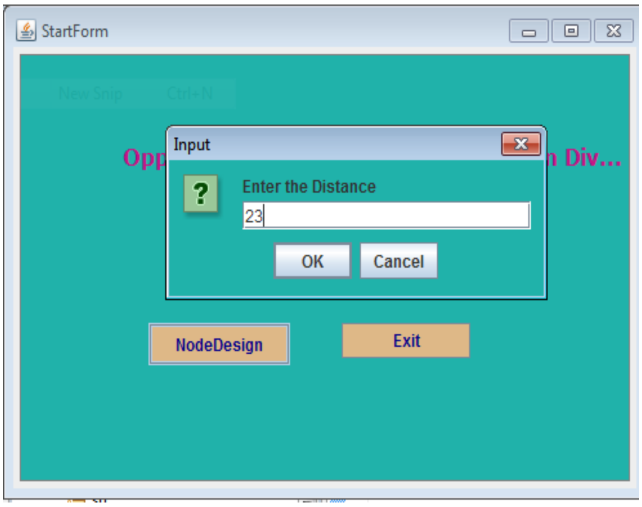
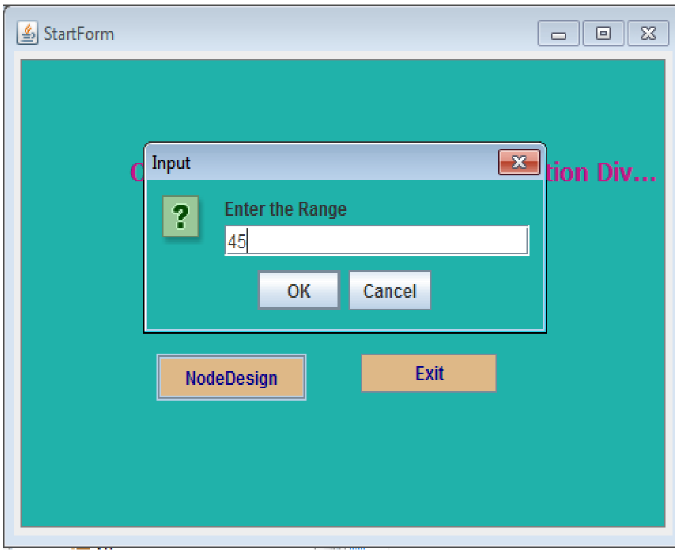
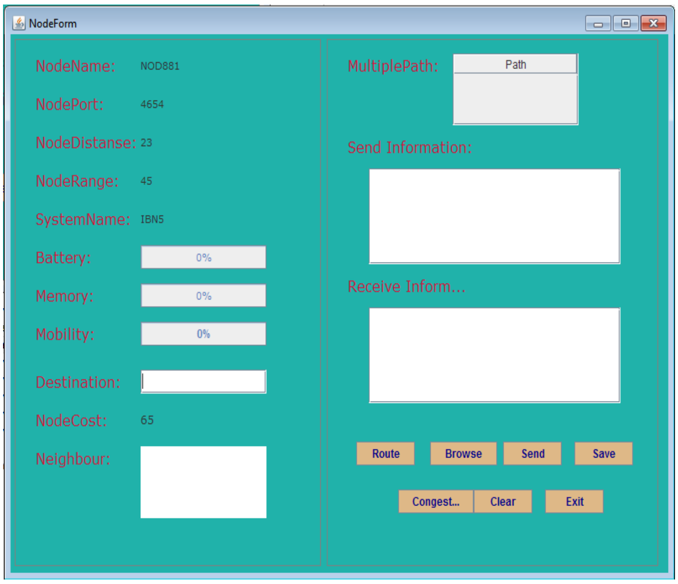
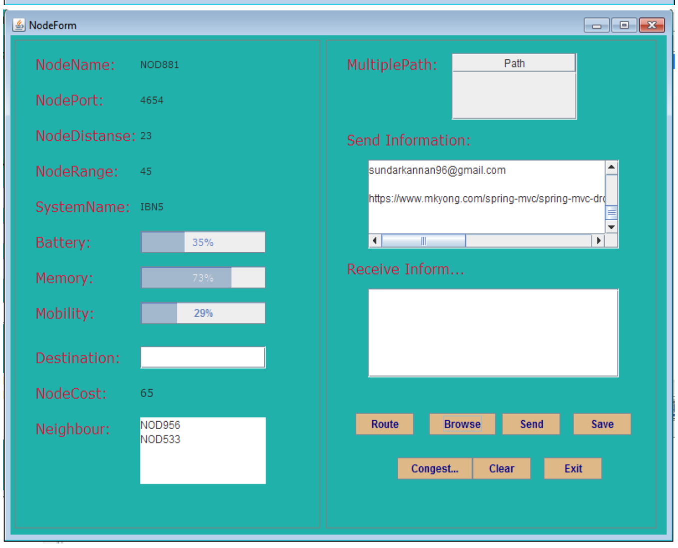
SCREEN SHOTS











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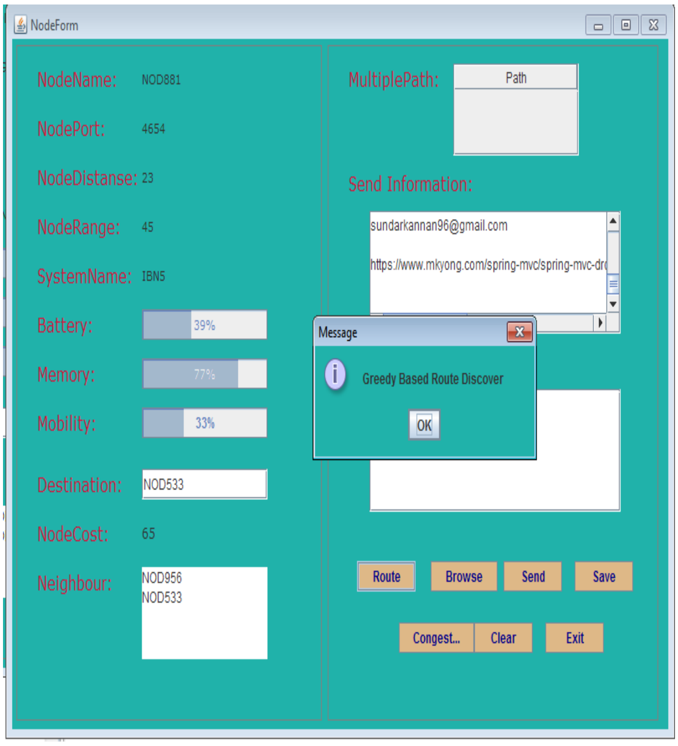

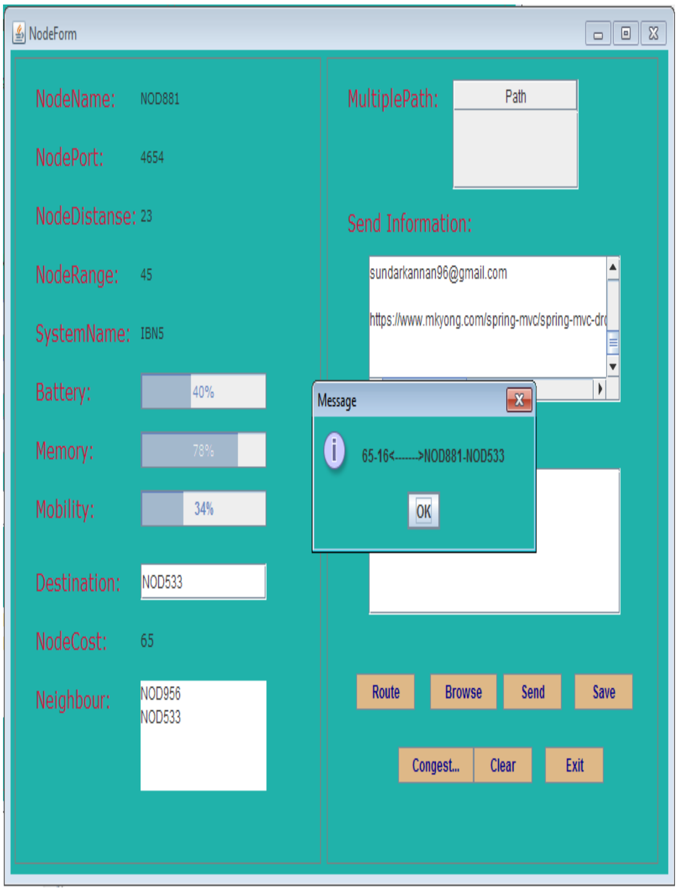

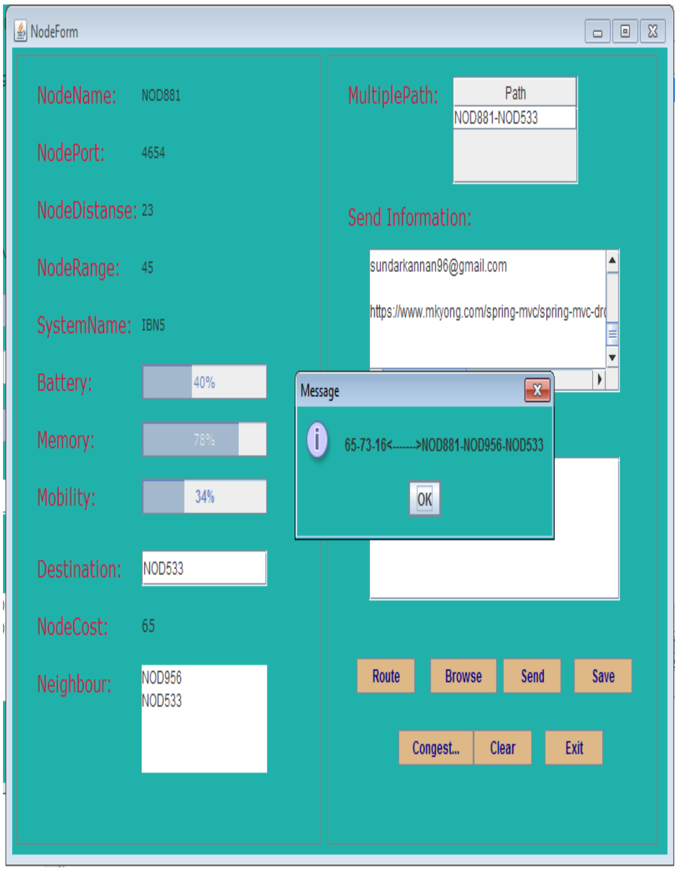

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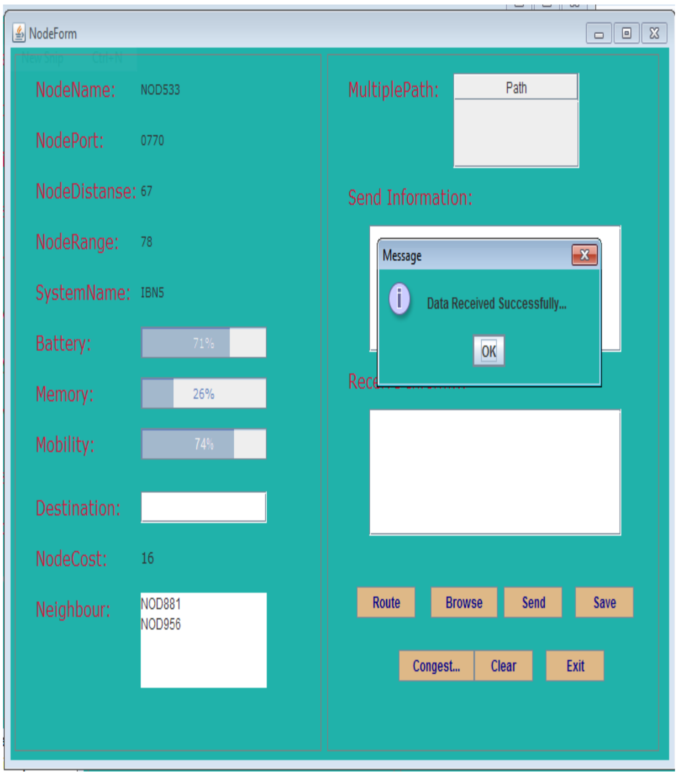

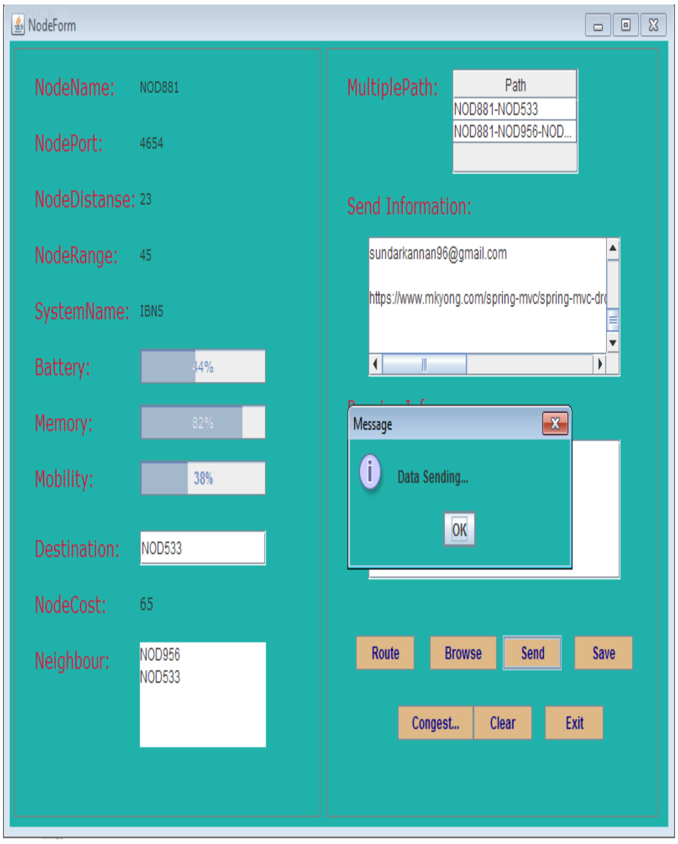

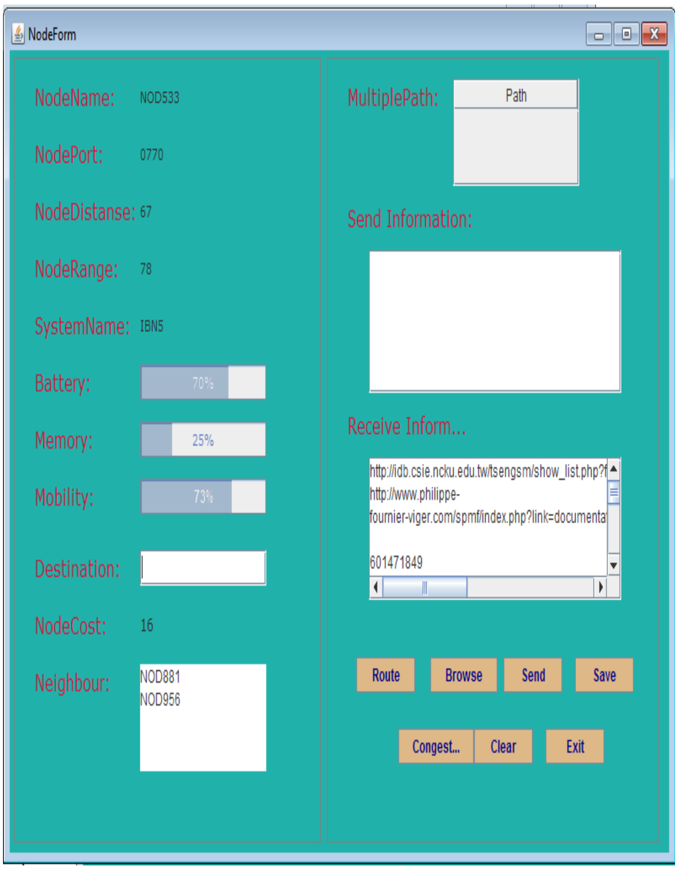

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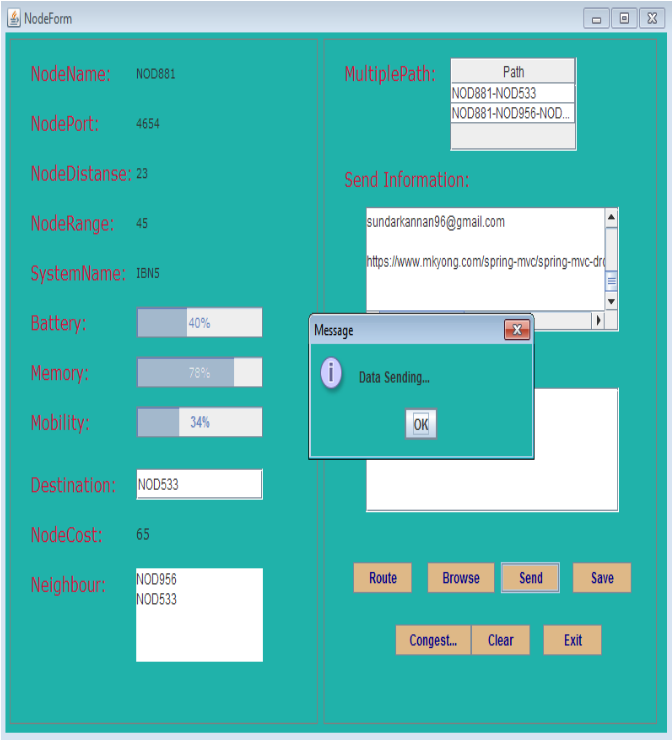

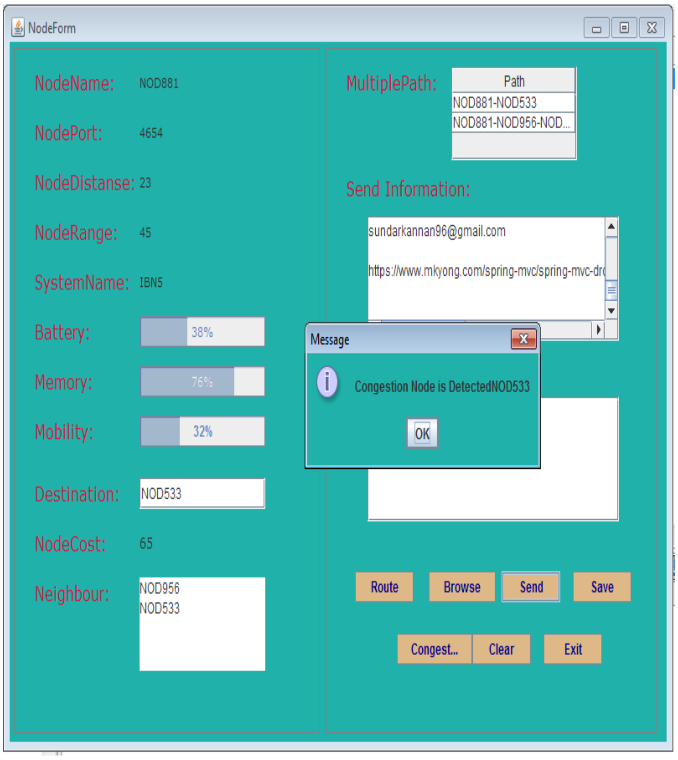

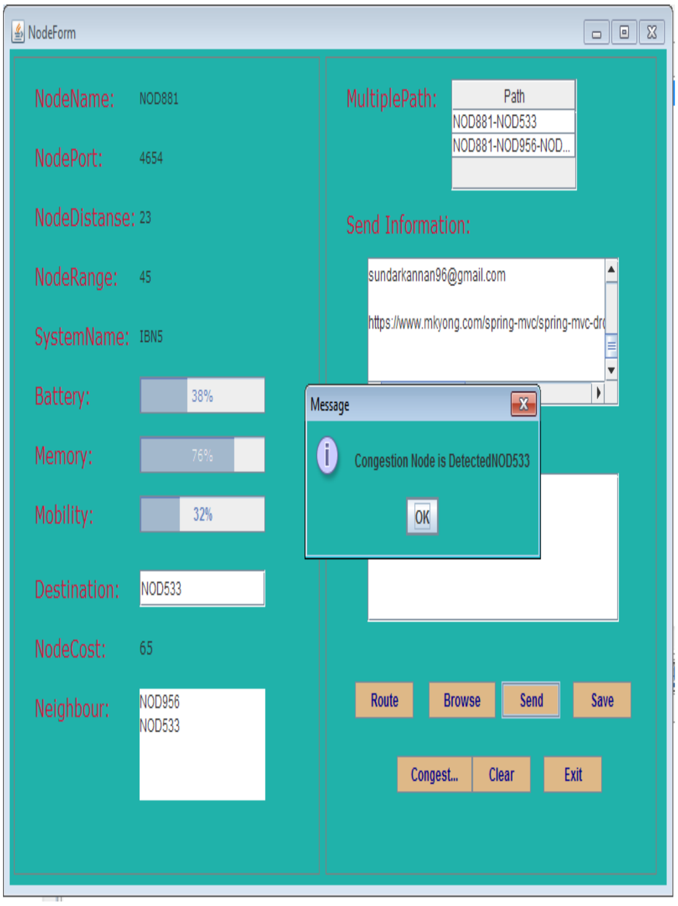

CONCLUSION

In this paper, we provided a distributed opportunistic routing policy with congestion diversity (D-ORCD) by combining the important aspects of shortest path routing with those of backpressure routing. Under this policy packets are routed according to a rank ordering of the nodes based on a congestion measure. Furthermore, we proposed a practical distributed and asynchronous 802.11 compatible implementation of D-ORCD, whose performance was investigated via a detailed set of QualNet simulations for practical and realistic networks. Simulations showed that D-ORCD consistently outperforms existing routing algorithms. We also provided theoretical throughput optimality proof of D-ORCD.

- In D-ORCD, we do not model the interference from the nodes in the network, but instead leave that issue to a classical MAC operation. The generalization to the networks with inter-channel interference seem to follow directly, where, the price of this generalization is shown to be the centralization of the routing/scheduling globally across the network or a constant factor performance loss of the distributed variants . In future, we are interested in generalizing D-ORCD for joint routing and scheduling optimizations as well considering the system-level implications. Incorporating throughput optimal CSMA based MAC scheduler with congestion aware routing is also promising area of research. The design of D-ORCD requires knowledge of channel statistics. Designing congestion control routing algorithms to minimize expected delay without the topology and the channel statistics knowledge is an area of future research.

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