

Thesis title: Modification of the AODV Routing Discovery Mechanism in Wireless

Mesh Networks

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- Some sentences are complex and could be simplified for better readability. For example, in the paragraph discussing DSDV, the sentence "Routes with the most recent sequence numbers are chosen, and settling time is used to optimize routes by delaying routing updates" might be clearer if broken down into simpler sentences.
- In the introduction chapter, including some real-world application scenarios or case studies could make the concept more relatable and practical.
- The related studies present varied findings regarding the performance of AODV in comparison to other protocols. For instance, one study suggests AODV outperforms others, while another indicates areas for improvement. A critical discussion of these discrepancies would enhance the presentation of the related work.
- While the related work chapter mentions the need for further research and improvements, there is still a need for more explicit discussion on the identified gaps in existing studies. Clearly outlining these gaps would guide future researchers in addressing specific challenges and give strong justification for the need for the proposed work in this thesis.
- Since the AODV is the native protocol used in this study, a more in-depth examination of AODV's mechanics and intricacies could enhance the critical analysis of its Up-to-date limitations.
- A table of comparison of the most recent related improvements on the AODV protocol in contrast with the proposed modifications in this study is needed.
- In Table 2.1, while the objectives mention related chapters and publications, specific citations (e.g., [C1], [B1], [J2]) are not explained. Providing a legend or footnotes for these references would enhance clarity.
- While the integration of fuzzy logic is mentioned in Chapter 2, a brief rationale or theoretical foundation explaining why fuzzy logic is chosen and how it aligns with the research aim could strengthen the justification.
- I like the details given about the use of PRISMA method in conducting the systematic LR, though, it would be great to have a bit more detailed information about the methodology used in assessing the eligibility of the selected papers.
- In section "3.1.11 In-Depth Critical Analysis of Routing Protocols" several facts were highlighted without supporting them with proper references, e.g. "This study's findings are juxtaposed with the routing protocol delineated by Maaza and Khelifa for the Energy Reversed Ad-Hoc On-Demand Distance Vector (ERAODV), which exhibits up to 1.7% increased energy efficiency compared to the conventional AODV Request EXT. AODV EXT demonstrates a data throughput enhancement exceeding 19% over the standard AODV and 10% over ERAODV. The" and "some of the main advantages of AODV:"

- It has been mentioned that several attempts for optimising the AODV protocol along with some proposed methods, without a detailed explanation of the technicality of the optimisation method used in such attempts. Adding more detail on this would improve the clarity of the current studies.
- Only 28% of the presented related methods in Table 3.1 are coming from the last 5 years' published works, while the rest are a bit outdated, could you please increase the number of the recent related works in your comparison? Apply the same on the similar presented comparisons.
- The summary section of Chapter 3 should be improved by critically summarising the key findings of the presented SLR.
- In Chapter 4, while the theoretical foundation is strong, the work lacks empirical validation or real-world implementation results. Including simulation results or practical experiments would strengthen the credibility of the proposed FCEE routing protocol.
- Chapter 4 introduces a set of fuzzy rules for decision-making but could benefit from a more in-depth discussion of the rationale behind the specific rules chosen. Providing insights into the decision-making process would be great. Also, the work does not explicitly discuss the usability and scalability of the proposed FCEE protocol. Addressing these aspects, especially in the context of large-scale wireless mesh networks, would be valuable.
- The methodology section provides an overview of the simulation process, data analysis, and performance evaluation criteria. It would be beneficial to elaborate further on the criteria for performance evaluation to facilitate a comprehensive understanding of the results.
- More explanation with some examples should be provided in Figure 4.7, especially on the presented conditions.
- Chapter 5, provides a more detailed justification for the choice of the Random Waypoint Mobility Model will benefit the justification behind such choice. Explain how this model aligns with the characteristics of the targeted wireless mesh network scenarios and why it was deemed suitable over other mobility models.
- Also, in chapter 5, try to elaborate on why the FCEE routing protocol might negatively impact TCP performance, providing more insights into the specific challenges and interactions between these protocols in wireless networks. Also, try to make figure captions more descriptive.
- Chapter 5 appropriately discusses the differences between Constant Bit Rate (CBR) and Transmission Control Protocol (TCP) traffic. However, it would be beneficial to elaborate on how the proposed FCEE routing protocol specifically handles these two types of traffic in mesh networks.
- Also, while the chapter mentions the FCEE routing protocol and its adaptation to CBR and TCP traffic, the specifics of how it achieves this adaptation are not deeply explained. Try to provide more details on the mechanisms within the FCEE protocol that facilitate efficient routing for both traffic types.
- The explanation of the Pareto traffic model is informative, but it would be helpful to clarify how exactly the FCEE protocol integrates with this model. Try to provide insights into how FCEE adapts to the bursty nature of Pareto traffic and the implications on routing decisions.

- You should clearly state and justify the assumptions made during the modelling process. For example, assumptions related to network area, node density, and variable node speeds should be explicitly defined.
- Chapter 5 mentions performance metrics like throughput, delay, packet delivery ratio, packet loss ratio, and average energy consumption. Elaborate on how these metrics are measured and calculated in the context of the simulations, providing a clear understanding of the evaluation criteria.
- Please expand section 5.5 to cover the key points presented in this chapter.
- While there's mention in chapter 6 of the FCEE protocol using fuzzy logic principles, additional details on how these principles are integrated into the routing decisions would be valuable for a more comprehensive understanding.
- In chapter 6, try to briefly justify the choice of protocols for comparison. Why were AODV, IRAODV, STAB-AODV, SSAODV, and Enhanced-Ant-AODV selected as the benchmark protocols?
- Ensure consistency in terminology throughout the results chapter. For example, "packet drop count" is mentioned in some sections, while "packet delivery ratio" is used in others. A uniform terminology would eliminate confusion.
- Chapter 6 mentions the integration of fuzzy logic into the FCEE protocol but lacks an in-depth discussion on how fuzzy logic enhances the decision-making process. Providing insights into the fuzzy logic mechanisms and their impact on the protocol's performance would contribute to the technical depth of the findings.
- I would like to have a discussion on the scalability issues associated with the FCEE protocol. Discussing potential scalability challenges, along with proposed solutions, would provide a more comprehensive evaluation.
- Furthermore, I would like to see a complexity analysis of the proposed FCEE protocol in comparison to the existing ones.
- In chapter 7, in the "Conclusions" section, engage more deeply with the limitations of the study. Acknowledge any constraints or challenges faced during the research and discuss how these limitations could be addressed in future work.
- Ensure the text is free of grammatical errors and typographical mistakes.
- Finally I would like to suggest to update the thesis title to something reflecting three things, 1) Research Problem, 2) Main Objective, and 3) Proposed Method; currently I can't see these things well reflected in the title.

Some questions could be asked during the Viva session:

- Can you provide a brief overview of your motivation for this research?
- What challenges or gaps in the existing literature prompted you to undertake this study?
- How does the integration of fuzzy logic contribute to the improvement of AODV?
- Could you explain the significance of the memory channel concept in the FCEE protocol?
- How did the FCEE protocol compare with traditional AODV and other routing protocols in your experiments?

- How do variations in node density, network size, and other factors impact the performance of the FCEE protocol?
- Are there specific challenges or aspects that you were unable to address in this study, and how might these be explored in future research?

Recommendations:

According to the presented work and results as well as the demonstrated knowledge in publishing the work in some of the peer-reviewed journal articles and conferences, I would recommend it for possible defense with the consideration of addressing the above-listed comments and feedback.

Associate Professor. Dr. Ali Sadiq

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 Recoverable Signature

Ali Sadiq

Dr

Signed by: a7cdf973-10c3-49fb-8fff-d6a6d3b7b18d