CIS654: Paper

Names of all group members: Aavash Chaudhary, Pushpa Pandey, Raju Lama

1. What is the advanced networking topic you chose?

The advanced networking topic we chose for this paper is Networking in Internet of Things (IoT). We selected this topic because IoT is being adopted across various platforms, and the number of connected devices is rapidly increasing and the topic sounds more familiar as well.

2. What are the titles of these two papers and what are their general themes respectively?

Paper 1 is titled 'Robot-Assisted Maintenance of Wireless Sensor Networks Using Wireless Energy Transfer'. This paper introduces a framework called WINCH that utilizes mobile robots to wirelessly charge battery-powered sensors in a wireless sensor network. By doing so, it extends the network's lifetime and improves its reliability. The system integrates energy-aware routing and optimal robot deployment.

The Paper 2 is titled 'Adaptive Self-Healing in Mobile Networks Using Lévy Flight-Based Bat Algorithm'. This paper presents a novel algorithm (LFBA) inspired by bat behavior and Lévy flight patterns to detect and repair failures in mobile IoT networks. It focuses on restoring network connectivity automatically when nodes move or fail, making the network self-healing and robust in dynamic environments.

3. Why is networking important in your topic based on these two papers?

Networking plays a central role in IoT systems because it enables devices to communicate, coordinate, and function as a collective system. Without a stable and efficient networking layer, even the most advanced IoT devices would be isolated and ineffective. Both papers demonstrate this importance in different but complementary ways.

In Paper 1, networking is essential for organizing and maintaining communication between energy-constrained sensors. The paper uses a cluster-based networking protocol (LEACH-C) where certain sensors act as communication leaders (cluster heads) to collect and forward data. This routing structure enables efficient functioning of the network. Networking also helps in reporting energy levels to a central base station, which coordinates where and when robots should wirelessly recharge the sensors.

In Paper 2, networking is used to maintain connectivity in mobile and dynamic environments. As devices move or disconnect, the LFBA algorithm detects these changes and automatically

reconfigures routing paths to restore communication. The self-healing capability ensures continuous data flow, which is essential in real-time and mobile IoT applications.

4. How do networking approaches work in these two papers respectively?

In Paper 1, the networking approach is based on a centralized clustering protocol known as LEACH-C. Sensors are grouped into clusters, and each cluster has a head that communicates with the base station. The base station collects energy level and position data from the sensors, selects cluster heads, and then assigns charging robots to the appropriate sensors. This integrated system ensures efficient routing and energy management.

In Paper 2, the networking approach relies on a distributed, adaptive algorithm called LFBA (Lévy Flight-Based Bat Algorithm). It models mobile nodes in a network and simulates natural behavior to detect faults and adaptively reconfigure network routes. The system continuously monitors the network for failures and repairs broken communication paths by adjusting node positions or choosing alternative routing paths.

5. What are the differences of networking approaches between these two papers?

The networking approaches in both papers differ significantly in focus and execution. Paper 1 deals with relatively static sensor networks where energy conservation and maintenance are the primary concerns. It uses a centralized clustering protocol and physical robot movement to solve energy-related challenges.

On the other hand, Paper 2 addresses the challenges of mobility and fault tolerance in dynamic IoT networks. It uses a bio-inspired algorithm for adaptive routing and fault recovery. While Paper 1 uses a hardware-assisted strategy involving robots and energy-aware clustering, Paper 2 focuses on algorithmic intelligence to handle failures autonomously.

6. What are the novelties of these two papers respectively?

In Paper 1, the novelty lies in the WINCH framework, which uniquely combines routing and energy replenishment through robot-assisted wireless charging. This dual approach enables both efficient communication and prolonged network lifetime. The integration of LEACH-C with mobility planning of charging robots is a distinct innovation in IoT networking.

In Paper 2, the novelty is in the LFBA algorithm itself. It enhances the traditional Bat Algorithm by incorporating Lévy flight patterns, allowing for better exploration and faster convergence. This method allows the system to detect network faults and recover more effectively than traditional approaches, making the network adaptive and resilient in real-time scenarios.

7. What did the authors do to show the performances of their networking approaches in these two papers respectively? (In other words, what kind of performance evaluation did the authors do?)

In Paper 1, the authors conducted simulation experiments using the NS-2 simulator to assess the effectiveness of the WINCH framework. They evaluated performance metrics such as energy consumption, network lifetime, robot travel distance, and data delivery ratio. These simulations confirmed that WINCH improves energy balance and prolongs the operational life of sensor networks.

In Paper 2, the authors used NS-3 and MATLAB to simulate the behavior of LFBA in a mobile network environment. They compared it with the standard Bat Algorithm and Particle Swarm Optimization (PSO) across various conditions, measuring performance in terms of throughput, energy usage, delay, and recovery time. The results demonstrated superior performance of LFBA in maintaining connectivity and minimizing downtime.

8. What are the conclusions of these two papers respectively?

The Paper 1 concludes that the WINCH framework is an effective solution for maintaining the functionality of wireless sensor networks. By combining routing optimization with wireless energy transfer via mobile robots, the system significantly extends network life and ensures more stable operation.

The Paper 2 concludes that the LFBA algorithm offers a powerful tool for adaptive fault recovery in mobile IoT networks. It outperforms existing optimization methods and maintains reliable communication even under high mobility and node failure conditions. This makes it a promising approach for future real-time and autonomous IoT systems.

9. What are the future works of these two papers mentioned by the authors respectively?

The Paper 1 suggests further research into optimizing robot movement paths and improving the clustering process to enhance energy efficiency and scalability in larger networks. They also propose integrating mobility prediction for better charging planning.

The Paper 2 plans to extend their research by incorporating machine learning and software-defined networking (SDN) to make the LFBA algorithm more intelligent and responsive. They also intend to test the approach in real-world IoT environments to validate its effectiveness.