I. Problem: Implement a PSO-based proactive routing mechanism to collect the data from the IoT devices over a wireless ad-hoc network.

Setup: Raspberry Pi (preferred) or Laptop devices will work as intermediary nodes in the ad-hoc network.

Priors: There exists at least one IoT device that can collect data from its sensors. The data is generated at some random intervals.

Problem details: A Raspberry Pi node collects IoT data through its sensors. However, it needs to be transferred to a remote server for processing and analysis. Another set of Raspberry Pi nodes acting as intermediary nodes will form an ad-hoc network. However, they do not have a routing algorithm. The objective is to develop a functional routing mechanism to transfer the generated data from the source to the server.

Expected features:

1) Proactive route generation
2) Node mobility management
3) Failure handling

II. Problem: Implement a PSO-based reactive routing mechanism to collect the data from the IoT devices over a wireless ad-hoc network.

Setup: Raspberry Pis (preferred) or Laptops will work as intermediary nodes in the ad-hoc network.

Priors: There exists at least one IoT device that can collect data from its sensors. The data is generated at regular intervals.

Problem details: A Raspberry Pi node collects IoT data through its sensors. However, it needs to be transferred to a remote server for processing and analysis. Another set of Raspberry Pi nodes acting as intermediary nodes will form an ad-hoc network. However, they do not have a routing algorithm. The objective is to develop a functional routing mechanism to transfer the generated data from the source to the server.

Expected features:

1) Reactive route generation
2) Node mobility management
3) Failure handling

III. Problem: Implement a QoS-aware data forwarding mechanism from an IoT source to a sink on an IoT gateway.

Setup: Raspberry Pi devices or any laptops can work as intermediary nodes in the ad-hoc network.

Priors: There exist two or more IoT devices that can collect data from their sensors. The data is generated at random intervals. There exists one intermediary node that works as a gateway.

Problem details: Multiple Raspberry Pi nodes collect IoT data through their sensors. However, they need to be transferred to a remote server for processing and analysis. An IoT gateway device provides communication between the server and the IoT device. The objective is to implement a data forwarding mechanism that forwards the data generated by these devices based on the priority level of the devices. A high-priority device should be given a better utilization of the available bandwidth.

Possible features:

a) Priority-based data forwarding
b) Stream data support
c) Node mobility management
d) Buffering in case a node goes out of range.

IV. Problem: A service discovery protocol for available services in the network.

Setup: A set of devices in the network host a set of services in the form of a distributed system.

Priors: There exist two or more IoT devices that host services/microservices in the network. There exists a database that keeps track of available services and their locations in the network.

Problem details: Multiple services (such as printing, and file-sharing) are hosted at different nodes in a network. However, there is no mechanism to know where a service is available. The objective is to discover these services both proactively and on demand. Whenever a node searches for a service, it should be replied with the location (Address of the node) of the service. At regular intervals, updated status (availability, load, etc.) of the known (interested) services should be maintained by individual nodes.

Possible features:

a) Service discovery on request
b) Updating of the records whenever a new service becomes unavailable.
c) Caching timeout and other optimization to increase the efficiency of the discovery mechanism.

V. Problem: A publish-subscribe model for data transfer.

Setup: A set of IoT devices in the network generate IoT data due to some events.

Priors: There exist two or more IoT devices that generate IoT data due to some events. We call them publishers. There exists a set of devices that consume data generated by the publishers to perform further processing. We call them subscribers. There exists a centralized gateway node that works as a broker.

Problem details: The broker needs to deliver the generated data from the publishers to the subscribers. However, the communication has to be asynchronous. Whenever a publisher generates data, the broker queues it and forwards it to all the relevant subscribers. The broker maintains a distributed queue for this purpose.

Possible features:

a) Publisher records maintenance
b) Subscriber records maintenance
c) Distributed queue maintenance
d) Delivery of the publisher data to all subscribers asynchronously.