3 |Mobile Sink Improved Energy–Efficient PEGASIS–based Routing Protocol with Direct Transmission Mobile Sink Improved Energy–Efficient PEGASIS–based Routing Protocol with Direct Transmission (MIEEPB–DT) improved energy utilization and network lifetime by switching the sink node instead of keeping it static.76 The basic principle of multi–chain, which divides the area into close and far nodes, is to reduce the distance between connected nodes in the chain by using fewer sensors and reducing the overhead.Enhanced Cluster Based Routing Algorithm Developed for Mobile WSNs An adaptation of the CBR–Mobile algorithm is Enhanced Cluster Based Routing Algorithm Developed for Mobile WSNs (ECBR–MWSN).48 It contains five phases, initialization, the formation of the cluster, and selection of CHs, the transmis– sion of data, rerouting, and clustering.Improved Mobile Sinks Based Energy–Efficient Clustering Algorithm An Improved Mobile Sinks Based Energy–Efficient Clustering Algorithm (IMECA) is a cluster–based routing protocol that depends on different predictable movement paths for the MSs.74 The main objective of IMECA is to decrease the distance between the CHs and the expected routes of the MS and increase network longevity.Anycast Tree–Based Routing Protocol This protocol orga– nizes and preserves the routing tree between the MSNs and the MS. All sensors on the constructed route utilize the unicast mode instead of broadcast mode for requesting transmission to transmit the sensory information from a sensor to the sink.Particle Swarm Optimization –Based Routing Protocol with Mobile Base Station A Particle Swarm Optimization –Based Routing Protocol with Mobile Base Station (PSO–MBS) routing protocol that depends on PSO utilizing MBS was proposed in Latiff et al.66 to achieve efficient utilization of the energy and amelio– rate the lifetime and PDR of WSNs.Energy–efficient and reliable routing protocol (E2R2) E2R2 is a protocol that deals with sink and node mobility as a whole divides the network into clusters by choosing one CH and two deputies CH in each cluster.78 To save energy and minimize re–clustering time, the sink nodeselects a collection of likely CH sensors and forms the CH panel in this protocol.Comparison between protocols for the mobility of both sensor and sink nodes together A comparison of the routing protocols for the mobility of both sink and sensor nodes together in MWSNs based on mobility pattern, several sinks used, control manner, mobile element, network construction, cluster density, cluster size, intra/inter–cluster routing, protocol goals, and applicationsParticle Swarm Optimization Based Selection The PSOBS protocol is utilized and enabled the sink for selecting its RP according to the data position of all sensors to reduce the EED, ensure net– work coverage, and preserve the sink path cost.Low–energy Adaptive Clustering Hierarchy–Centred Cluster Head Low–energy Adaptive Clustering Hierarchy–Centred Cluster Head (LEACH–CCH) is a new clustering protocol aimed to enhance the MWSN lifetime.56 LEACH–CCH is an enhancement to the LEACH protocol used for static networks.Mobility–aware Centralized Clustering Algorithm Mobility–aware Centralized Clustering Algorithm (MCCA) that depends on the three–layer hierarchy aims to reduce data loss and achieve energy–efficient clustering.57 MCCA implements centralized gridding at two tiers.Routing protocols for MSN in MWSNs 3.2.1 |ROUTING PROTOCOLS 3.1 |3.2.4 |3.2.5 |3.2.6 |3.2.9 |3.2.12 |3.2.13 |3.2.14 |3.3.1 |3.3.2 |3.3.3 |3.3.4 |3.3.5 |3.3.6 |3.3.13 |3.3.14 |3.3.15 |3.3.16 |3.4 |3.4.2 |3.4.3 |3.4.4 |