Additional Material

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I. CH SELECTION

The CH selection procedure is provided in Algorithm 1. In this algorithm, CH-ad denotes CH-advertisement packet, where CH-ad.nodeid and CH-ad.energy are the CH node’s identity and advertised residual energy level, respectively. The variable “own” denotes a node $j$ that receives the advertisement.

Algorithm 1 CH Selection: At node $j$ in $R_i$

1: Current energy level: $E(j)$
2: if $j$ is CH-candidate then
3: $E_{ch} \leftarrow own.energy$ and $CH \leftarrow own.nodeid$
4: Transmit a CH-ad with radius $r_i$
5: Listen for CH-ads for time-period $T_{wait}$
6: for each received CH-ad do
7: if Reported energy in CH-ad $\geq E(j)$ then
8: $CH \leftarrow CH$-ad.nodeid
9: $E_{ch} \leftarrow CH$-ad.energy
10: end if
11: end for
12: end if
13: if $CH == own.nodeid$ then
14: $j$ is a CH
15: end if

II. CLUSTER FORMATION

Cluster formation is depicted in Algorithm 2. In this algorithm, CH-an, CH-assoc, and CH-conf denote CH-announcement, CH-association, and CH-confirmation messages, respectively.

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Algorithm 2 Cluster formation: At node $j$ in $R_i$

1: if $j$ is CH then
2: Transmit a $CH-an$ with radius $\alpha r_i$
3: Listen for $CH-assocs$ for $T_{\text{Wait}}$
4: for each received $CH-assoc$ do
5: Transmit a $CH-conf$ to $CH-assoc.nodeid$
6: end for
7: else
8: $RSSI_{ch} \leftarrow 0$ and $CH \leftarrow \text{null}$
9: Listen for $CH-ans$ for time-period $T_{\text{Wait}}$
10: for each received $CH-an$ do
11: if $RSSI$ in $CH-an \geq RSSI_{ch}$ then
12: $CH \leftarrow CH-an.nodeid$
13: $RSSI_{ch} \leftarrow CH-an.RSSI$
14: end if
15: end for
16: At expiry of time-period $T_{\text{Wait}}$:
17: if $CH \neq \text{null}$ then
18: Transmit a $CH-assoc$ to $CH$
19: Listen for $CH-conf$ from $CH$ for time period $T_{\text{Wait}}$
20: end if
21: if $CH == \text{null}$ OR “No $CH-conf$ received” then
22: while $CH == \text{null}$ do
23: Transmit a $CH-assoc$
24: Listen for $CH-conf$ for time period $T_{\text{Wait}}$
25: if No reply then
26: Increment transmission range
27: end if
28: end while
29: end if
30: end if