

## Claims

1. A network property-based single-antenna MAC transmission method in the cognitive wireless sensor network is characterized in that it is comprised of steps as listed hereinafter:

Step 1: When a data packet is to be sent, access competition among the wireless sensor nodes of all users in control channel of CRSN is enabled to acquire to-be-used data channel

Step 2: The to-be-sent data packet transmits data one by one according to data transmission unit via to-be-used data channel;

Step 3: The wireless sensor nodes on the sender and the receiver of the to-be-sent data packet activate the built-in data channel timer and return to Step 1 to send the remaining packets therein until all are sent;

So called wireless sensor nodes are comprised of an available channel list, the back-off timer and the data channel timer, wherein the available channel list refers to the form of the storage data channel information maintained by each wireless sensor node, while the information in the form is comprised of channel number and channel occupancy time; the back-off timer is a time setting device used in each wireless sensor node and randomly waiting before the packet is sent; the data channel timer is a time setting device used to record the occupancy time of the data channel in the listed data channels.

2. The single-antenna MAC transmission method according to Claim 1 is characterized in that: the so called access competition processing means (i) first segmenting the to-be-sent data packet to get a number of data transmission units with the same transmission duration and in the same size, (ii) conducting back-off processing for the data transmission unit and activating the back-off timer, and then (iii) judging overtime and determining the to-be-used data channel.

3. The single-antenna MAC transmission method according to Claim 2 is characterized in that: the so called segmentation means dividing the to-be-sent data packet into data transmission units, and when the remaining part of the to-be-sent data packet is not long enough for the duration of a data transmission unit, the remaining part is processed as a data transmission unit.

4. The single-antenna MAC transmission method according to Claim 1 or 2 or 3 is

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characterized in that: the duration of the so called data transmission unit is  $T_u$ , which is equal to the maximum interference tolerance time, aka  $T_d^{max}$  of the user with the highest priority (i.e. the primary user) in the control channel.

5. The single-antenna MAC transmission method according to Claim 2 is characterized in that: the so called back-off processing means detecting each to-be-sent time slot:

- a) detecting whether the control channel is idle during the time slot;
- b) whether there is an available channel in the available channel list, namely, whether there exists a channel whose channel occupancy time is zero;
- c) the maximum channel occupancy time of the available channel is less than or equal to the transmission duration;

decrease the back-off timer by 1 when all the above conditions are met; otherwise, freeze the back-off timer and conduct back-off processing another time.

6. The single-antenna MAC transmission method according to Claim 5 is characterized in that: the so called maximum channel occupancy time means the maximum time that is allowed by the data channel for wireless sensor nodes to occupy the channel in this access when wireless sensor nodes are switched to the specified data channel for data transmission, and the time duration  $T_{cmax}$  is determined by the data channel utilization rate of the primary user:

$$T_{cmax} = \begin{cases} 1 \times (T_u + T_c) & U > 0.5 \\ 2 \times (T_u + T_c) & 0.2 < U \leq 0.5 \\ 3 \times (T_u + T_c) & 0 < U \leq 0.2 \end{cases},$$

wherein:  $U$  represents the utilization rate of the primary user using the data channel,  $T_c$  means the time used for channel detection, and  $T_u$  is the duration of the data transmission unit.

7. The single-antenna MAC transmission method according to Claim 2 is characterized in that: the so called overtime judgment means: if the time in the back-off timer is longer than the random-waiting time value set for the back-off process conducted by the wireless sensor nodes before sending the packet, it is deemed that overtime occurs, and the sender and the receiver determine a to-be-used data channel via RTS/CTS/CCTS coordination in the control channel; in selecting a to-be-used data channel, the priority is given to a channel in the available channel list whose maximum channel occupancy time

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is supported by  $T_{\text{cmx}}$  or its duration is less than the transmission duration; otherwise, back-off processing is conducted another time.

8. The single-antenna MAC transmission method according to Claim 7 is characterized in that: the so called RTS/CTS/CCTS coordination means: the sender first sends an RTS packet which contains the available channel information recorded by the sender nodes, after the RTS packet is received, the receiving nodes select an available data channel according to the available channel information provided by RTS and combining the information in the self-maintained list of available channels, and feedback this message to the sender by CCTS data packet, and finally the sender informs its surrounding neighbor nodes by CCTS data packet of the channel selection this time.

9. The single-antenna MAC transmission method according to Claim 1 is characterized in that, the specific procedures of Step 2 are as follows: to conduct channel detection before the transmission of each data transmission unit, i.e., to monitor whether there exists a primary user in the data channel: if there exists a primary user, the wireless sensor nodes in the sender and the receiver of the to-be-sent data packet are immediately switched to the control channel and Step 3 is implemented; otherwise, it will start the communication of the data transmission unit.

10. The single-antenna MAC transmission method according to Claim 1 is characterized in that: the so called activation of the built-in data channel timer means: the wireless sensor nodes activate the data channel timer of the data channels in the above steps other than the to-be-used ones, and set the timing duration to be the maximum channel occupancy time of the data channel.