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Node Grouping Method in ZigBee Protocol Standard

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Recently, sensor network which can be extend to hold huge number of nodes, communicates wireless, networks which changes their topology dynamically is expected to implement the system in field such as home automation and environmental monitoring and factory automation. But, as their importance increasing, also the issue of technology has become simultaneously clear. Energy consumption and data transfer rate, production cost and security, and real time processing are typical problems. Especially, we are focusing on energy consumption and data transfer rate. As for the sensor which is installed in the place where people cannot access easily, improvement of efficiency of energy consumption and data transfer rate are important in order to operate for a long time. Accordingly, in order to improve these properties, wide discussion and proposition are done for the area such as directional antenna and method of a synchronized signal between nodes.

ZigBee protocol standard is published after consideration about these problems. ZigBee protocol standard supports not only star topology but also cluster-tree and mesh topologies. Cluster-tree and mesh can implement multi hop communication. When this standard is used, it can actualize home automation and environmental monitoring and factory automation easily. As the significant feature of ZigBee, IEEE802.15.4 is used as the lower layer. As a consequence of it, ZigBee achieves energy efficient and can work for a long time.

In this research, we focused on grouping method which overcomes the problems mentioned in the previous pant. And it is applied that to ZigBee protocol standard. Grouping method is proceeded as the following procedure. At first, ZigBee protocol stack is investigated. Next, the advantage of grouping method is compared with each layer. Finally, the implemented layer is decided. In this research, it was judged that I should implement grouping method with Network Layer.

A method of assigning group identification to the node and a method of managing group information with each topology must be defined because ZigBee supports the topology of three types such as star and cluster-tree and mesh. I proposed two patterns that give nodes group identification. One is writing to sensor board directly, the other is managed by the node which accepts join request. By supporting these two method, ZigBee can support not only dynamic network structure but also static. Next, additional field is declared to the neighbor table as the method of managing group information. Group identification field in neighbor table is used for transmit to ZigBee End Device. The star topology in which communication can be done with 1 hop is effective, but cluster-tree and mesh which communication is done with multi hop are not perfect. Two topologies of the latter ones need other routing table. The new two tables which named grouping table and group expansion routing table is declared. By using this table, it is possible to transmit the data which is designated to a group. But on the other hand, route discover algorithm in mesh topology, originator node need to discover more than one route at the same time because node must choose the most suitable route. This increased transmit waiting time of originator node. So I examine about waiting time derived from various parameter.

At last, the implementation and evaluation of the proposal method are carried out. For the purpose, MSSTATE_LRWPAN which is simple ZigBee protocol stack for education and research is used. The first, in this research, at least one grouping pattern applied to each application is used. Which is executed one of above mentioned the topologies. Secondary, investigate demanded application, and apply proposal grouping method. Thirdly, compute the total transmit waiting time in various situation. As a result, energy consumption and data transfer rate could achieve improvement of

efficiency regarding each topology.

As a conclusion, I proposed node grouping method in ZigBee protocol standard. The typical items that increase efficiency are energy consumption and amount of total data transmission. As a future subject, group identification should be allocated dynamically. And also the method in which data sent from leaf nodes can efficiently gathered should be implemented. By implementing the above mechanism, efficiency obtained from grouping method can be achieved much more.