협력통신에서의 Go-Back ARQ 프로토콜

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Go Back ARQ Protocol in Cooperative Communication

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Abstract

Automatic repeat request (ARQ) protocol is attention for recent years as one protocol for reliable, accurate signal at the destination. However, in almost recently proposed ARQ protocols, the authors only consider advantage about the diversity gain. In this paper, we propose a novel cooperative ARQ protocol with advantage about the bandwidth in which the source sends a number of frames before stopping and worrying about the acknowledgment.

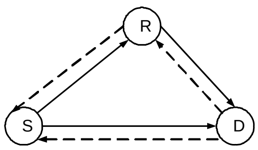
I. Introduction

Automatic repeat request (ARQ) is a protocol in which the destination requests to retransmit signal when it receives the erroneous signal. So ARQ technique is very efficient to combat the effect of fading. In ARQ protocol, the destination uses cyclic redundancy check code (CRC) to check the received signal. If the destination recognizes that the signal is wrong, it sends a Negative ACKnowledgement (NACK) message to transmitter to inform that the signal is incorrect and it needs to retransmit.
Otherwise, the destination sends the ACKnowledgement (ACK) message and the source continues transmitting next signal. Recently, many ARQ protocols have been proposed [1], [2], [3].
However, in those protocols after sending a frame or two frames in space time code to the destination, the source waits until it receives the ACK/NACK message it continues transmission next signal. Or the source uses a timer, the timer is counted from the time when it sends signal. After predetermined time, if the source does not receive the ACK or NACK, it resends signal. it is called as stop and wait ARQ (SW ARQ).
In this paper we propose using a novel ARQ for cooperative communication in which the relay is used to assist for resending to the destination. The protocols is called as Go Back ARQ (GB ARQ).

II. System Model

We consider a wireless sensor network consisting of the source (S), the relay (R), and the destination (D) as shown in Fig. 1. The transmission has two phases. In phase 1, the source broadcasts signal to the destination (the lines to transmit signal are indicated by solid lines). The relay also receives the signal. The destination receives the signal and checks it by using CRC. If the signal is correct, the destination sends ACK message. Otherwise, the it sends NACK message to request retransmission from the source or the relays. After receiving NACK message, the relay also decodes signal. If the signal is wrong, it sends NACK message to the source, otherwise it sends ACK message.
Fig. 2 shows the operation of GB ARQ protocols.

the transmitter keeps sending frames but keeps a copy in a buffer, which is called the transmission window W. The number of frames in the buffer is W which equals the number of frames sent by source before stopping and worrying about acknowledges. Frames from a sending source are numbered sequentially. Assume that the sequence numbers have range from 0 to N. If a erroneous frame arrives at the destination with the sequence number i, the destination will discard this frame and the frames with sequence numbers $i, i+1..., W$. Afterwards, the destination informs the transmitter for resending the frame. If the relay decodes correctly the frame with sequence numbers i, the relay sends all frames that it received from the source in the phase 1 beginning from frame i. Otherwise, the relay decodes incorrectly, the source forms a new window of W frames which consist of the discarded frames with sequence numbers $i, i+1..., i+W-1$.



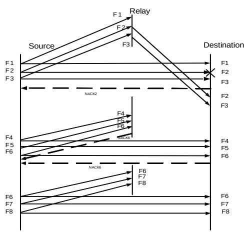


Fig. 1 Cooperative ARQ system Fig. 2 Flow diagram.

Ⅲ. Simulation Results

In the Fig 3, we show the simulation results of data link layer PER in traditional ARQ, using one relay for stop and wait ARQ, using GB ARQ with different average SNR of user channel in slow fading channel. When the number of frames in the window (W) increase, performance of the system is worse. However, the advantage of Go Back ARQ in the time domain is show in the Fig. 4 when time for wait ACK/NACK at the source is Twait, and probability loss ACK/NACK message is Pack=0.5

Ⅳ. Conclusion

The GB ARQ protocols is proposed and compared with previous protocol in time, diversity gain to find suitable protocol for each application. Our analysis shows that the source transmits a number of frames before stopping and worrying about ACK, NACK make the time consumption of system more efficient. However, in GB ARQ, the diversity is not as good as S-W so depending on the application we can choose the best protocol. Simulation results that are suitable with the analysis of theory prove correctly of analysis.

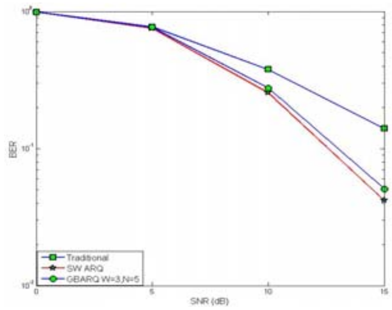


Fig 3. PER performance of ARQ protocol

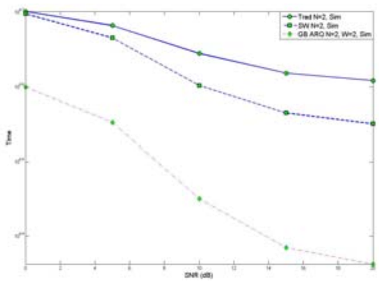


Fig. 4 Time consumption of ARQ protocol

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