Docket #: S12-057

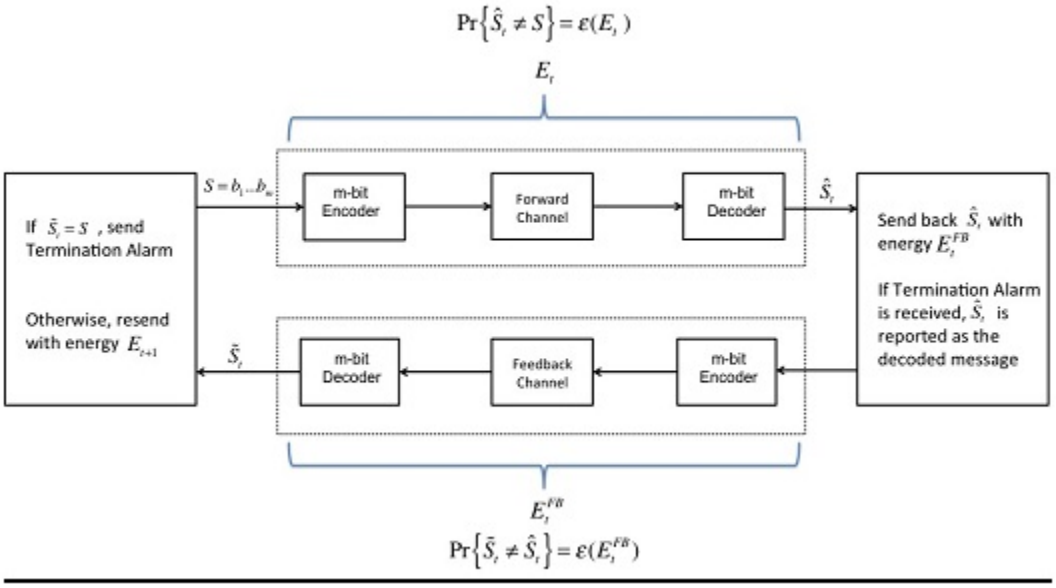
Energy-efficient Wireless Communications via Feedback

Stanford researchers have proposed the use of feedback to improve point-to-point radio performance under a total energy constraint. This framework allows for opportunistic use of feedback and avoids the use of feedback when its energy cost is more than its benefits, minimizing energy consumption per bit. The framework allows for the optimization of the total energy consumption on both ends of communication, not just one side.

Opportunistic power boosting techniques are used to optimize the total energy. This invention can be applied to a various low-power radio designs to take advantage of the interactive coding and modulation schemes that have been developed. These techniques significantly increase the energy efficiency of the radios, which is particularly important for sensor networks, body-area networks, and other Internet of Things (IoT) applications.

Video:
Energy-Efficient Communication via Feedback Video

Figure: Feedback diagram



Stage of Research:
- Proof-of-concept using simulation models and theoretical analysis
- Joint optimization of transmission plus encoding/decoding energy
- Continued research on more general optimization models.

Applications

- Wireless Networks
- Low Power Radios
- Sensor networks
- Body-area networks
- Internet-of-Things

Advantages

- **Interactive modulation schemes**
- **Efficient use** of battery power on mobile devices and any energy-limited device (e.g. sensors).
- **Opportunistic and dynamic use of feedback** and avoids the use of feedback when its energy cost is more than its benefits.
- **Total system energy optimization** (on both ends and for both forward and feedback link)

- **Opportunistic energy boosting technique**
- **A separate energy optimization layer** is introduced which can be tailored to various physical layer components
- The techniques for interactive communication can be applied bit-by-bit and even for uncoded transmission

Publications

- R. Mirghaderi, A. Goldsmith "Energy-Efficient Communication via Feedback," Wireless Communications, IEEE Transactions on (Volume:12, Issue: 7), July 2013.

Patents

- Published Application: 20140233395
- Issued: 9,515,774 (USA)

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