Error Detection and Correction for Low-Cost Nano Satellites

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Master thesis

Åpne

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Sammendrag
The objective of this paper is to suggest low-cost measures for dependability and robust Error Detection and Correction for use in applications such as nano satellites, where price is a primary concern. Different methods have been evaluated, with the main result mitigation Single Event Effects causing bit-flips in system memory utilizing BCH codes. The general implementation is resource intensive and the algorithm has been adapted to the embedded platform. The codes have been implemented on a low-cost microcontroller with a real time operating system and faults have been injected during run-time to emulate a radiation environment. The performance impact and dynamic behavior of the algorithms are studied with third party tools. The Error Correction and Detection should prevent the expected hundreds of errors per day from accumulating in memory and affect the system. The resulting design is expected to be able to mask even frequent resets and errors from the system's operation. Parts of this thesis have been accepted for publication and the papers are included in the appendices.

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Caleb Hillier, Vipin Balyan, "Error Detection and Correction On-Board Nanosatellites Using Hamming Codes", Journal of Electrical and Computer Engineering, vol. 2019, Article ID 3905094, 15 pages, 2019. https://doi.org/10.1155/2019/3905094. Show citation. Error Detection and Correction On-Board Nanosatellites Using Hamming Codes. The field of nanosatellites is constantly evolving and growing at a very fast speed. This creates a growing demand for more advanced and reliable EDAC systems that are capable of protecting all memory aspects of satellites. The Hamming code was identified as a suitable EDAC scheme for the prevention of single event effects on-board a nanosatellite in LEO. In this paper, three variations of Hamming codes are tested both in Matlab and VHDL. In information theory and coding theory with applications in computer science and telecommunication, error detection and correction or error control are

techniques that enable reliable delivery of digital data over unreliable communication channels. Many communication channels are subject to channel noise, and thus errors may be introduced during transmission from the source to a receiver. Error detection techniques allow detecting such errors, while error correction enables reconstruction of the Error Detection and Correction in Communication Networks. ∗. Chong Shangguan†and Itzhak Tamo‡. For the error detection problem, we obtain two lower bounds on the communication cost as functions of n, k, d, m, and our bounds are tight for several graphs and codes. For the error correction problem, we design a protocol which can eciently correct a single input error when G is a cycle and C is a repetition code. We also present several interesting problems for further research. Keywords: error detection, error correction, communication network Mathematics subject classications: 94B25, 68M10, 68P30. 1 Introduction. Let G be a connected simple graph on n vertices v1, . . . , vn, and C a code DCN - Error Detection & Correction - There are many reasons such as noise, cross-talk etc., which may help data to get corrupted during transmission. The upper layers work on some generalized view. Backward Error Correction When the receiver detects an error in the data received, it requests back the sender to retransmit the data unit. Forward Error Correction When the receiver detects some error in the data received, it executes error-correcting code, which helps it to auto-recover and to correct some kinds of errors. For example, fiber optics. But in case of wireless transmission retransmitting may cost too much. In the latter case, Forward Error Correction is used. To correct the error in data frame, the receiver must know exactly which bit in the frame is corrupted. Low-Cost INS/GPS Data Fusion with Extended Kalman Filter for Airborne Applications. by. Adriano Solimeno. The last decade has shown an increasing demand for small-sized and low-cost inertial navigation systems (INSs) for use in many airborne applications, such as unmanned air vehicles (UAVs) and general aviation. Advances in microelectronics, computers, and sensor technologies permitted the development of commercial low-cost inertial measurement units (IMUs) and GPS receivers. The integration of these two navigation technologies is a practical positioning option for airborne applications.