

Computer Engineering

Electronic and Communication Systems

Error correction code

Project Report

Federica Perrone

Summary

[Introduction 3](#_Toc89949812)

[General Algorithm 3](#_Toc89949813)

[Applications 3](#_Toc89949814)

[Possible Architecture 3](#_Toc89949815)

[Architecture description 4](#_Toc89949816)

[VHDL Code 5](#_Toc89949817)

[Test-plan 6](#_Toc89949818)

[Synthesis 7](#_Toc89949819)

[Conclusion 8](#_Toc89949820)

# Introduction

An error correcting code is an algorithm for expressing a sequence of numbers such that any errors, which are introduced, can be detected and corrected (within certain limitations) based on the remaining numbers.

The error correcting codes are used for controlling errors in data over unreliable or noisy communication channels.

The central idea is the sender encodes the message with redundant information in the form of an ECC. The redundancy allows the receiver to detect a limited number of errors that may occur anywhere in the message, and often to correct these errors without retransmission.

The two main categories of ECC codes are block codes and convolutional codes.

Hamming codes are a family of linear error-correcting block codes. Hamming codes can detect one-bit and two-bit errors, or correct one-bit errors without detection of uncorrected errors. Richard W. Hamming invented Hamming codes in 1950 as a way of automatically correcting errors introduced by punched card readers.

Due to the limited redundancy that Hamming codes add to the data, they can only detect and correct errors when the error rate is low.

Hamming codes have a minimum distance of 3, which means that the decoder can detect and correct a single error, but it cannot distinguish a double bit error of some codeword from a single bit error of a different codeword. Thus, some double-bit errors will be incorrectly decoded as if they were single bit errors and therefore go undetected, unless no correction is attempted.

In this context, an extended Hamming code having one extra parity bit is often used. Extended Hamming codes achieve a Hamming distance of four, which allows the decoder to distinguish between when at most one one-bit error occurs and when any two-bit errors occur. In this sense, extended Hamming codes are single-error correcting and double-error detecting, abbreviated as SECDED.

## General Algorithm

## Applications

## Possible Architecture

# Architecture description

# VHDL Code

# Test-plan

# Synthesis

# Conclusion