1. Introduction

This introduction situates and explains the problem this project deals with, besides a description of objectives and the organisation of the report.

Introduction

1.1. Situating the need for watermarking and image registration

Digital data makes live enjoyable for lots of people. The current trend towards representing, storing and sending digital data is clearly indicating this. The preference for digital represented data is often due to its good quality and ease of use. Digital data has also the feature of delivering copies which are bit-wise identical to the original, which is as well an advantage as a disadvantage. The creators of the data on one hand do not want their data to be copied and distributed without author rights being paid. The consumer, on the other hand, wants to make use of the benefits of creating digital data and storing this onto digital storage media. This leads to tensions between both groups and as one wants to limit the writing capabilities, the other group wants the right to write its own storage media. One of the possible solutions, which should satisfy both groups, is the use of watermarked data.

Watermarked data is digital data, which has got extra digital information inside to allow for example authentication. Depending on the type of watermark, the data can still be copied or not, if copying is still possible then the watermark is copied as well, this means that author identification is still possible, which should dissuade people from copying it. On the other hand, the people can still create their own data and write this to their storage media of choice.

Already quite a lot of watermarking methods exist, but the problem with most of them is that if a distortion is applied to the data, then the watermark cannot be extracted any more. This makes the use of watermarking for most of the applications of course worthless, as if a small distortion is applied, the authentication cannot be performed any more. This problem can be solved by either trying to find more robust watermarking methods or solving the distortion problem separately, using image registration methods.

1.2. The problem

The distortion applied to watermarked video can be of any type, but will not be very significant because the corrupter does not want a visible difference so that people using the distorted data do not get suspicious. As the creator of the data still has the original data, it can be used to find out and undo the distortion, leading to the possibility of extracting the watermark again.

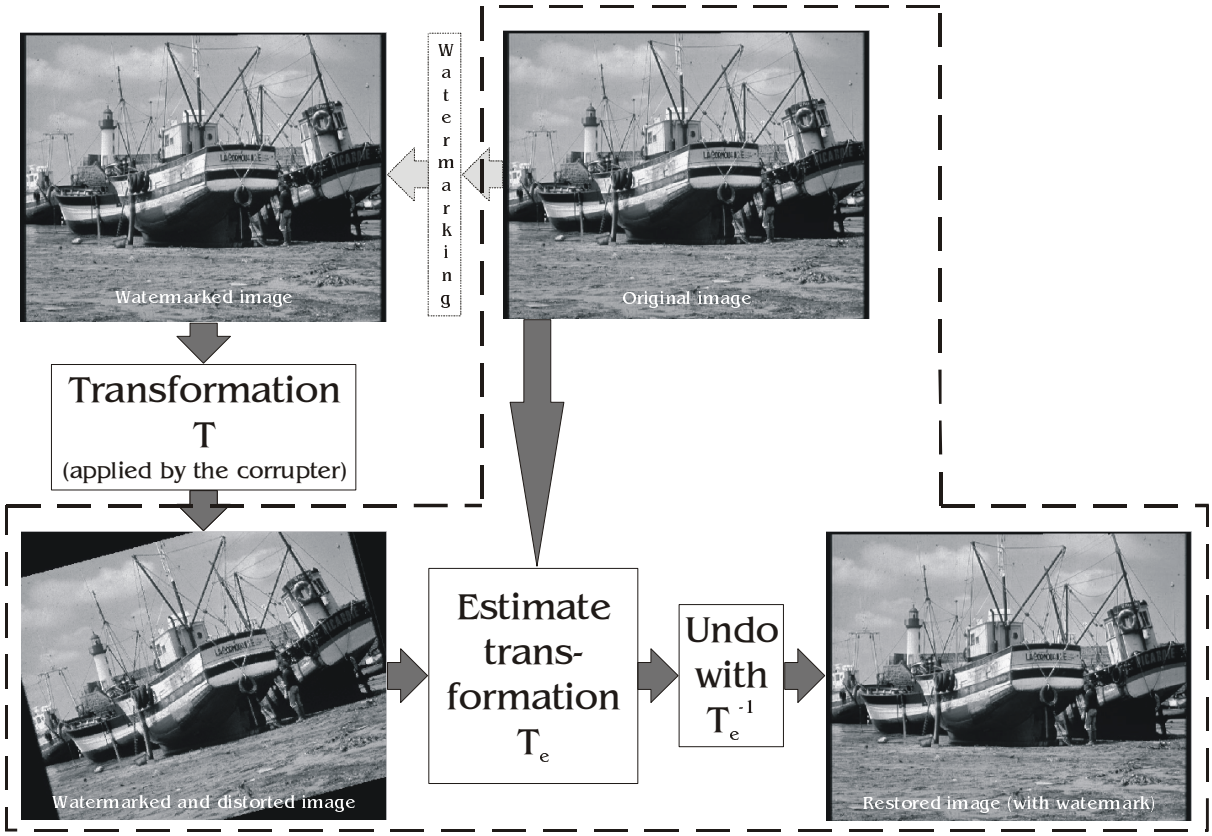


Figure 1.1: System description.

On the diagram above, the entire cycle is represented. It starts with the original data, which is watermarked and then distributed. Some corrupter decides to apply a transformation to the watermarked video in order to destroy the watermark inside the image. This transformation can be of any kind, as well linear as non-linear, global as local. At some stage the distortion applied has to be undone in order to extract the watermark successfully, this is done by estimating the applied distortion and undoing this, resulting in the undistorted, watermarked image. This last process (inside the doted line) is the system to be designed on a

reconfigurable computing platform. In a first step the estimation and undoing will focus on linear and global transformations, later on this might be expanded.

1.3. The assignment

As already mentioned in the above section, the purpose of this project is to solve the problem of image registration for watermarked video, having the watermarked and original data available.

1.4. Objectives

In order to solve the problem, first of all a method to be used for the image registration had to be selected / found. This also includes testing the algorithm before implementing it on the reconfigurable hardware platform.

Once the algorithm was working, it had to be implemented on the SONIC board for which VHDL (VHSIC Hardware Description Language) code should be produced. As the board also has to be configured before use and as a part of the algorithm might be performed in software, a part of C-code should be written too. Before the VHDL code would be mapped onto hardware, several simulations, using test benches to compare the results of the algorithm-test and algorithm for the hardware, needed to be done.

1.5. Organisation of the report

The second chapter of this report contains a description of the term watermarking, including some requirements, applications and an overview of the existing methods.

In the third chapter, the concept of image registration is discussed. This chapter explains image registration, besides providing applications were image registration is already used and giving a description of the current methods.

The next chapter gives a description of the development of the used algorithm based on motion vectors. This contains as well a few failed methods as the succeeding one.

The description of the hardware to be used, combined with a description of the actual implementation and their respective test benches is provided in the fifth chapter.

The appendices contain the code of as well package, block itself and test bench for both parts implemented on hardware.