

STEGANOGRAPHY APPLICATION FOR
X-RAY IMAGE OF THE TRANSFERRED
PATIENT USING LEAST SIGNIFICANT
BIT METHOD

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I/We* hereby declare that I/We* have checked this thesis/project* and in my/our* opinion, this thesis/project* is adequate in terms of scope and quality for the award of the degree of *Doctor of Philosophy/ Master of Engineering/ Master of Science in

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I hereby declare that the work in this thesis is based on my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously or concurrently submitted for any other degree at Universiti Malaysia Pahang or any other institutions.

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ABSTRAK

Kini, internet seolah-olah menjadi sangat penting kerana ia adalah salah satu cara yang paling berkesan untuk berkomunikasi. Pertumbuhan pemancaran data melalui internet membantu pengurusan penjagaan kesihatan untuk memudahkan akses dan pengedaran maklumat pesakit. Walau bagaimanapun, maklumat pesakit yang dipindahkan terdedah kepada pihak ketiga dan mereka boleh dengan mudah menggunakan atau memanipulasi maklumat tersebut. Dalam projek ini, kaedah steganografi imej menggunakan teknik spatial domain dicadangkan untuk menyembunyikan maklumat pesakit dalam imej perubahan mereka untuk tujuan penghantaran. Menggunakan teknik yang paling popular dalam domain spatial, teknik Least Significant Bit, kami menggantikan bit paling sedikit imej penutup dengan bit data. Kaedah yang dicadangkan hanya digunakan untuk imej X-ray pesakit. Sebaik sahaja kaedah yang dicadangkan disesuaikan dan diterapkan dalam projek ini, hasilnya menunjukkan bahawa kualiti imej stego yang tinggi selepas proses dicapai.

ABSTRACT

Nowadays, internet seems to be really important since it is one of the most effective ways to communicate. The growth of data transmitting over the internet helps healthcare management for easy access and distribution of patient's information. However, the patient's information that being transferred is exposed to the third party and they can easily use or manipulated the information. In this project, an image steganography method using spatial domain techniques is proposed to hide the patient's information into their medical image for transmission purposed. Using the most popular techniques in spatial domain, Least Significant Bit technique, we replaced the least significant bit of the cover image with the data bit. The proposed method is applied only to X-ray image of the patient. Once the proposed method is adapted and applied in this project, the results indicated that the high quality of the stego-image after the process is achieved.

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LIST OF SYMBOLS

Σ	N-Ary Summation
α	Parameter used to adjust the relative importance of three components
β	Parameter used to adjust the relative importance of three components
Υ	Parameter used to adjust the relative importance of three components

LIST OF ABBREVIATIONS

MSE	Mean Square Error
ROI	Region of Interest
RONI-LSB	Region of Non Interest-Least Significant Bit
LSB	Least Significant Bit
PSNR	Peak Signal-to-Noise Ratio
ARE	Absolute Reconstruction Error
SSIM	Structural Similarity Index Metric
RAD	Rapid Application Development
MATLAB	Matrix Laboratory

CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

In the modern world of the communication technology, the security of the data transmitted becomes the main concern and one of the technique that can protect this data and information is using steganography. Steganography come from Greek word which means concealed writing. The word “steganos”, has a meaning as covered, and “graphial“ has a meaning of writing. Steganography is a not only hide the data but at the same time it also hide the fact that the secret data is transmitted. Only the intended recipient knows the existence of the secret data in steganography (Kour & Verma, 2014).

Data hiding is an old technique used to hide data in an image. Data hiding in medical images is very important to avoid any misuse of the data which may lead to wrong diagnosis and treatment. There are various attack that are prevalent to hack the data that hidden inside the cover image (Manoharan, Vijila, Sathesh, & Ponraj, 2012). There is several types of steganography which is images, text, audio and video steganography. Since text, image, audio and video is part of digital data that can be transmitted, it is important to protect it to maintain it’s confidential. Many data hiding of secret information into medical images system have been developed using various type of techniques such as Spatial Domain Methods, Spread Spectrum Technique, Statistical Technique and Transform Domain Technique. Some of existing system combined two or more technique to get optimum results.

In order to make an “invisible” communication, various types of techniques, method and tools are needed to complete a steganography message. It is recommended to use suitable tools and techniques of steganography so that the quality of image is not

disturb. The performance of the system can be determined by comparing the output image (stego-image) with the cover image. One of the factors that can be used to determine the performance of the system and the efficiency of the technique used is Mean Square Error (MSE) by calculated MSE between stego-image and cover image. The size of secret information that will be used to be embedded into the images is one of the reasons that reduce system's performance since it might effects the quality of the stego-image. If the MSE value is low, it shows that the stego-image quality is very good. In this project, we want to propose steganography technique on images that will be focused to ensure that stego-image is indistinguishable from the cover images.

1.2 PROBLEM STATEMENT

One of the issues that are related to this project is that when patient who have been confirm with a disease need to transfer from the current hospital (hospital A) to another hospital (hospital B). This can happen when the current hospital do not have an expert in that kind of disease, they need to transfer the patient to another hospital so that the patient will get further treatment. Many problems can occurs between the transferring hospital and receiving hospital. The transferring hospital need to clearly mention the reasons and the condition of the patient that need to transfer to another hospital to avoid any misunderstanding. When the patient who need to transfer from one hospital to another hospital, the doctors need to communicate to the doctors from new hospital in order to explain about the patient's disease. To avoid the patient from undergo same process from the start, both of the hospital can use this system to embedded patient's information into the transferred patient's x-ray images and give the stego-image to the doctor of hospital B. This system will helps the two hospital to communicate with each other without much exposing the patient's information.

There are many steganography application that have been published to public for example OpenStego (Samir Vaidya, 2014). OpenStego is an easy to use software tool that enable their user to hide message into their image. This software also include use of key or password in order to protect from unauthorized people. However, this software is not suitable for hospital use because it does not consider the region of non-interest (RONI) of the image. Almost all of the medical images such as x-ray image, contains important area known as the Region of Interest (ROI). This region should not be altered

to maintain the quality of the medical image. This encourage us to design a new steganography application for x-ray image of the transferred patient using RONI-LSB method that is specifically for the hospital use only.

1.3 OBJECTIVE

The main goals of this project that need to be achieved are:

1. To design a steganography application that can be used by the hospital to hide information in x-ray's image of their transferred patient.
2. To implement steganography algorithm using Least Significant Bit method.
3. To evaluate the system by calculating Mean Square Error (MSE), Peak Signal-to-Noise Ratio (PSNR), Absolute Reconstruction Error (ARE) and Structural Similarity Index Metrix (SSIM) value.

1.4 SCOPE

The scope of this project encompasses:

1. This project will only focus on hiding patient's information in x-ray images only.
2. The technique that will be used to hide patient's information is Least Significant Bit (LSB).
3. The software to develop the system is MATLAB on Windows platform.
4. The input for this system which is the information of the transferred patient is in the text form only.
5. The limit of the text is depends on the size of patient's x-ray images.
6. This system is design for hospital use only.

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