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# Comparison of Spread Spectrum with Redundant Pattern Coding In Securing Text Messages Into Audio

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ABSTRACT

The transmission of information from one place to another is mostly constrained by the security problems of the information itself. Moreover, this information is very confidential, so not just anyone can open it. One of the ways that can be done to hide confidential information is by using cryptographic techniques, namely by encoding the information using certain algorithms. The second way is to insert the information into certain media, such as digital images or audio, so that the information will be hidden and what will appear is the media only, while the information is disguised. In this study, the comparison of the Spread Spectrum steganography algorithm with the Redundant Pattern Coding algorithm to secure text messages in audio files. The data used are audio files with a size between 200 Kb to 265 Kb and text with a size of 50 bytes to 275 bytes. The experimental results obtained stego audio files from the insertion of the Spread Spectrum algorithm with an average PSNR value of 41,138 db and for the Redundant Pattern Coding algorithm the average PSNR value was 29,885 db.

**Keywords**:
Steganography, Spread Spectrum algorithm and Redundant Pattern Coding



## 1. Introduction

The transmission of information from one place to another is mostly constrained by the security problems of the information itself. Moreover, this information is very confidential, so not just anyone can open it. There are many ways that can be done to hide information, namely by encrypting, namely by encoding the information using a certain algorithm and inserting it into the audio, so that the information will be hidden and what will appear is the media only while the information is already hidden [3].

Audio is a physical phenomenon produced by the vibration of an object in the form of an analog signal with an amplitude that changes continuously with time called frequency. During vibrating, a pressure difference occurs in the surrounding air. The oscillation pattern that occurs is known as a wave. Waves have the same pattern that repeats at certain intervals, which are known as periods. Examples of periodic sounds are musical instruments, bird singing while examples of non-periodic sounds are coughing, splashing waves and others [1].

The Spread Spectrum technique is a data transmission technique where the psedonoise code is used as a modulation wave to spread signal energy over a bandwidth that is much larger than the information signal bandwidth. The basic idea is to spread information signals over a wider bandwidth to prevent interception and other interference. The term spread spectrum is used because in this system the transmitted signal has a much wider bandwidth than the information signal bandwidth. This information signal bandwidth distribution process is called spreading. This spread is useful for increasing the level of redundancy. The amount of redundancy is determined by the multiplier (CR) which is scalar. The length of the bits resulting from this spread becomes CR times the length of the initial bits. The message insertion process in this method consists of three processes, namely spreading, modulation and inserting data into the cover media. While the extraction process consists of three processes, namely taking messages from the frequency matrix, demodulating and de-spreading [7].



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The Pattern Coding method inserts data into the cover media by replacing the least significant bit (LSB) at each sampling point with a coded binary string. In the arrangement of bits within a byte (1 byte = 8 bits), there are the most significant bits (MSB) and the least significant bits (LSB). The bit that has the highest significance is the numeric which has the highest value (for example, 27 = 128) means the most significant bit or MSB, while the least significant bit is the one with the lowest value (for example, 20 = 1) which means the least significant bit or LSB . For example, we will insert the character "s" into the message section, then the first step is to read the binary value from the ASCII value of the character "s". Whereas the Redundant Pattern Coding method is to repeatedly write down the information you want to insert so that if a cuting process occurs, the information inserted will still be readable, but there are also disadvantages with this method, namely the number of messages inserted is limited [5].

## 2. Method

In this study, a comparison of the Spread Spectrum steganography algorithm with Redundant Pattern Coding in securing text messages into audio files was carried out. In making a comparison, the parameter used is the Peak Signal to Noise Ratio (PSNR), which is the amount of noise that occurs in the resulting stego audio file. The research steps are as follows:

a) Input the audio file as the cover media where text data will be inserted.
b) Input the text file that will be inserted into the audio file
c) Read the audio file header and insertion text.
d) Audio file processing and text insertion binerization
e) Insert the binary text into the audio file according to the respective algorithm.
f) Calculate the value of the Peak Signal Noise Ratio (PSNR) of each audio stego resulting from the insertion.
g) Conclusion of each steganographic algorithm

The steps of the Spread Spectrum algorithm in inserting the cover audio file with message text are as follows [5]:

a) Read text data and audio files with Wav format
b) Text data is represented in the form of binary numbers.
c) Text data in the form of binary numbers duplicated by the chip.
d) Text data is modulated with random signals to produce pseudorandom signals.
e) Text data is distributed using the Direct Sequence Spread Spectrum, with the binary number 1 represented by 1 and -1
f) Text data with value 1 is represented in imaginary form and those with value - 1 are represented in imaginary form.
g) The audio cover signal is represented by Fast Fourier Transform (FFT).
h) Text data is inserted into the audio cover signal.
i) Text data that has been inserted is converted to an amplitude form so as to produce an audio signal containing secret data.

The insertion steps with the Redundant Pattern Coding algorithm are [7].

a) Reads binary value from ASCII value character "s" as follows where S ASCII code = 115 binary value 01110011.
b) Take one by one part of each bit, namely 0,1,1,1,0,0,1,1. Then for each part of the bit, it will be inserted into the data using the Pattern Coding or LSB method. For example, we will insert the character "s" in 8 bytes of the carrier file or bits of the accommodating media. Pattern coding or LSB is marked with an underscore.
   11100101 11000101 00101001 10010110
   01100011 00111101 00111000 10010110
c) Perform logical AND and OR operations where each message bit is inserted if it is zero (end bit 0) then an AND operation is carried out, otherwise if the inserted message bit is 1 then the OR logic operation is performed. 01110011 is the binary form of the character “s”. These eight bits can be written into the Pattern Coding or LSB of each byte of the eight carriers as follows:
   11100100 11000101 00101001 10010111
   01100010 00111100 00111001 10010111



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## 3. Research Flowchart

In Figure 1, the comparison of the Spread Spectrum steganography algorithm with Redundant Pattern Coding in securing text messages into audio files begins with the insertion of Audio file data as cover media and text as inserted data. Furthermore, steganography is performed with the Spread Spectrum algorithm and Redundant Pattern Coding. The result of inserting text into an audio file in the form of an audio stego file is calculated the PSNR value and the conclusion is drawn which is the best. In this study, the comparison flowchat of the Spread Spectrum steganography algorithm with the Redundant Pattern Coding in securing text messages into audio files can be seen as in Figure 1.

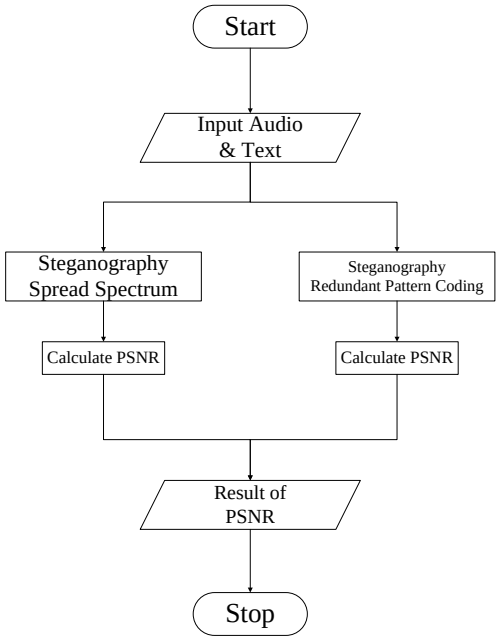


**Fig 1.** Research Flowchart

## 4. Result and Discussion

### 4.1 Result

1. Spread Spectrum Algorithm

Insertion results using the Spread Spectrum Algorithm can be seen in Table 1.

**Table 1.**
Spread Spectrum Algorithm Testing Results

| No | Cover *Audio* (.wav) | Size (Kbyte) | Text Embed (byte) | PSNR |
|---|---|---|---|---|
| 1 | Balon | 215 | 50 | 45.54 |
| 2 | Battery Critical | 250 | 75 | 43.25 |
| 3 | Battery Low | 265 | 100 | 42.42 |
| 4 | Critical Stop | 220 | 125 | 41.55 |
| 5 | Default | 210 | 150 | 41.01 |
| 6 | Ding | 241 | 175 | 40.54 |
| 7 | Error | 250 | 200 | 40.10 |
| 8 | Exclamation | 200 | 225 | 39.75 |
| 9 | Feed Discovered | 250 | 250 | 39.12 |
| 10 | Hardware Fail | 215 | 275 | 38.10 |
| | | | Average | 41.138 |

The results of the insertion test with the Spread Spectrum algorithm on wav audio files with a size between 200 Kb to 265 Kb with text with a size between 50 bytes to 275 bytes with an average PSNR value of 41,138. Data in the table above, it can be obtained a graph of the insertion results as in Figure 2.



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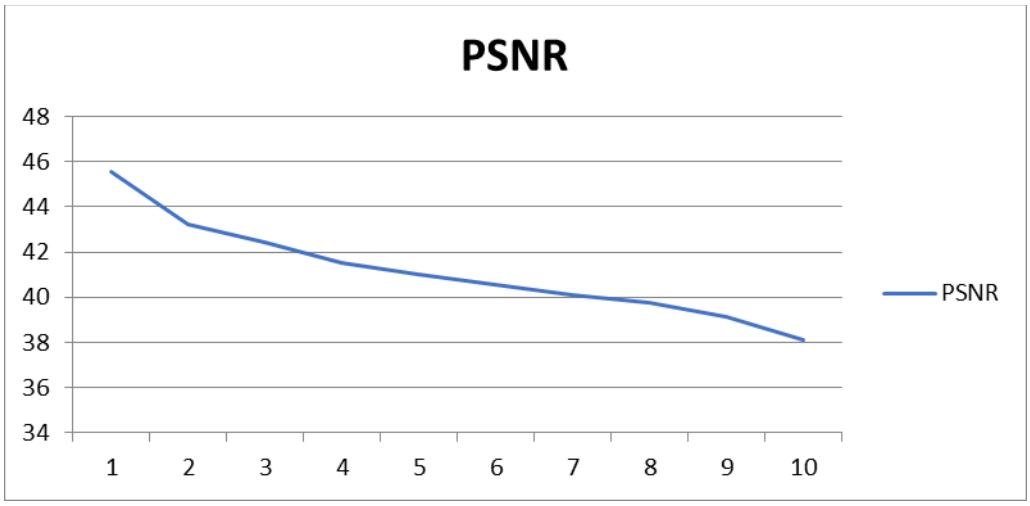


**Fig 2.** Graph of PSNR Value for Spread Spectrum Steganography Algorithm

2. Redundant Pattern Coding Algorithm

Insertion results with the Redundant Pattern Coding Algorithm can be seen in Table 2.

**Table 2.**
Testing Results of the Redundant Pattern Coding Algorithm

| No | Cover *Audio* (.wav) | Size (Kbyte) | Text Embed (byte) | PSNR |
|---|---|---|---|---|
| 1 | Balon | 215 | 50 | 32.52 |
| 2 | Battery Critical | 250 | 75 | 32.11 |
| 3 | Battery Low | 265 | 100 | 31.84 |
| 4 | Critical Stop | 220 | 125 | 31.12 |
| 5 | Default | 210 | 150 | 30.74 |
| 6 | Ding | 241 | 175 | 29.45 |
| 7 | Error | 250 | 200 | 28.41 |
| 8 | Exclamation | 200 | 225 | 28.04 |
| 9 | Feed Discovered | 250 | 250 | 27.40 |
| 10 | Hardware Fail | 215 | 275 | 27.22 |
| | | | Average | 29.885 |

The results of the insertion test using the Redundant Pattern Coding algorithm in wav audio files with a size between 200 Kb to 265 Kb with text with a size of between 50 bytes to 275 bytes with an average PSNR value of 29,885. Data in the table above, it can be obtained a graph of the insertion results as in Figure 3.



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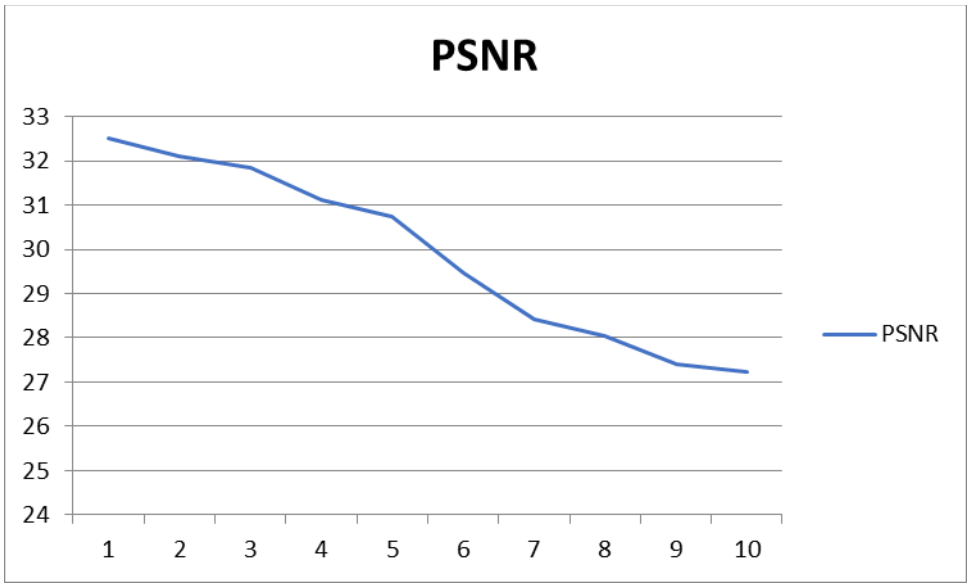


**Fig 3**. Graph of PSNR Value for Steganography of Redundant Pattern Coding Algorithm

### 4.2 Discussion

From the results of the insertion of the two algorithms above, it can be seen the comparison of the PSNR value as in Figure 4.

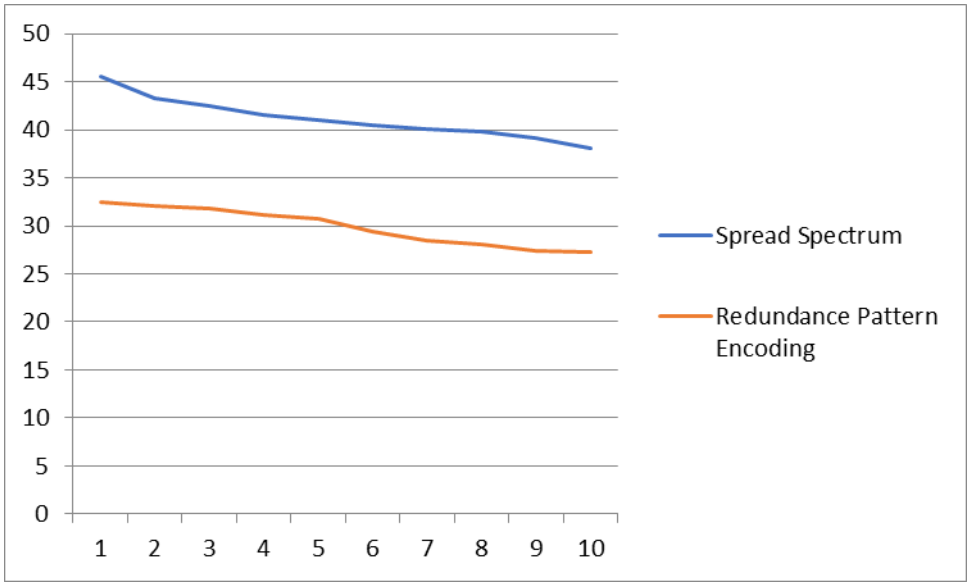


**Fig 4**. Comparison Graph of PSNR Value

## 5. Conclusion

In this study, the Spread Spectrum steganography algorithm has been compared with the Redundant Pattern Coding in securing text messages into audio files with the comparison of the parameters used, namely the Peak Signal to Noise Ratio (PSNR), which is the amount of noise that occurs in the resulting audio stego file. The experimental results obtained stego audio files from the insertion of the Spread Spectrum algorithm with an average PSNR value of 41,138 db and for the Redundant Pattern Coding algorithm the average PSNR value was 29,885 db. From the results above, it can be seen that the Spread Spectrum algorithm produces a better PSNR value than the Redundant Pattern Coding algorithm. This is because the Spread Spectrum algorithm inserts message data into the text data inserted into the audio cover signal where the text data that



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has been inserted is converted to an amplitude form so as to produce an audio signal containing secret data so that the PSNR value is better. Whereas in the Redundant Pattern Coding algorithm the message data that has been given is inserted into the LSB bit repeatedly which causes the audio data to change which results in a lower PSNR value.

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