|  |  |  |  |
| --- | --- | --- | --- |
| Attack Type | NC | BER | Extracted watermark |
| Noise addition | 0.9206 | 10.16 | Citizen(awgn).jpg |
| Re-sampling | 0.9335 | 8.50 | Citizen(resampling).jpg |
| Low-pass filtering | 0.9241 | 9.67 | Citizen(lpf).jpg |
| Re-quantization | 0.9285 | 9.08 | Citizen(requantized).jpg |
| Echo | 0.9256 | 9.47 | Citizen(echo).jpg |
| Reverse | 0.9389 | 7.81 | Citizen(reverse).jpg |
| mp3 compression (32 kbps) | 0.9227 | 9.86 | Citizen(32).jpg |
| mp3 compression (64 kbps) | 0.9307 | 8.79 | Citizen(64).jpg |
| mp3 compression (128 kbps) | 0.9278 | 9.18 | Citizen(128).jpg |

1. NC and BER of Extracted Watermark Image for the Audio Signal ‘Citizen, Go Back to Sleep’

|  |  |  |  |
| --- | --- | --- | --- |
| Audio Signal | Attack type | NC | BER |
| Beginning of the End | Noise addition | 0.9298 | 8.98 |
| Re-sampling | 0.9240 | 9.77 |
| Low-pass filtering | 0.9270 | 9.38 |
| Re-quantization | 0.9280 | 9.18 |
| Echo | 0.9288 | 9.18 |
| Reverse | 0.9175 | 10.45 |
| MP3 compression (32 kbps) | 0.9324 | 8.69 |
| MP3 compression (64 kbps) | 0.9145 | 10.84 |
| MP3 compression (128 kbps) | 0.9248 | 9.57 |
| Breathing On Another Planet | Noise addition | 0.9193 | 10.25 |
| Re-sampling | 0.9161 | 10.64 |
| Low-pass filtering | 0.9128 | 11.04 |
| Re-quantization | 0.9175 | 10.45 |
| Echo | 0.9152 | 10.84 |
| Reverse | 0.9070 | 11.82 |
| MP3 compression (32 kbps) | 0.9230 | 9.77 |
| MP3 compression (64 kbps) | 0.9085 | 11.52 |
| MP3 compression (128 kbps) | 0.9089 | 11.52 |
| Thousand Yard Stare | Noise addition | 0.9247 | 9.57 |
| Re-sampling | 0.9254 | 9.47 |
| Low-pass filtering | 0.9252 | 9.47 |
| Re-quantization | 0.9106 | 11.43 |
| Echo | 0.9219 | 9.96 |
| Reverse | 0.9131 | 11.04 |
| MP3 compression (32 kbps) | 0.9249 | 9.57 |
| MP3 compression (64 kbps) | 0.9229 | 9.86 |
| MP3 compression (128 kbps) | 0.9167 | 10.55 |

1. NC and BER of the Extracted Watermark for Different Audio Signals

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Attack | NC[Proposed] | NC[1] | NC[2] | NC[3] |
| 1 | 0.9206 | 0.9901 | 0.5870 | 0.6619 |
| 2 | 0.9335 | 0.9950 | 0.9924 | 0.7847 |
| 3 | 0.9241 | 0.9942 | 0.6272 | 0.5541 |
| 4 | 0.9285 | 1.0000 | 0.9634 | 0.5454 |
| 5 | 0.9256 | 0.7559 | 0.5820 | 0.7867 |
| 6 | 0.9389 | 0.4904 | 0.5737 | 0.6150 |
| 7 | 0.9227 | 0.9591 | 0.5774 | 0.4034 |
| 8 | 0.9307 | 0.9650 | 0.5673 | 0.4806 |
| 9 | 0.9278 | 0.9650 | 0.5524 | 0.7270 |

Table III

Comparison of NC among proposed and other algorithm

(*Citizen, Go Back to Sleep*)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Attack | BER[Proposed] | BER[1] | BER[2] | BER[3] |
| 1 | 10.16 | 1.17 | 47.85 | 37.50 |
| 2 | 8.50 | 0.59 | 0.98 | 25.00 |
| 3 | 9.67 | 0.68 | 43.65 | 50.00 |
| 4 | 9.08 | 0.00 | 4.69 | 49.00 |
| 5 | 9.47 | 27.83 | 49.02 | 25.00 |
| 6 | 7.81 | 56.64 | 48.63 | 43.75 |
| 7 | 9.86 | 4.79 | 49.51 | 62.50 |
| 8 | 8.79 | 4.10 | 49.71 | 56.25 |
| 9 | 9.18 | 4.10 | 52.25 | 31.25 |

Table IV

Comparison of BER among proposed and other algorithm

(*Citizen, Go Back to Sleep*)

1. S. M. Tsai, “A robust zero-watermarking scheme for digital audio,” *International Journal of Information and Electronics Engineering*, vol. 5, no. 2, pp. 117–121, 2015.
2. Y. Yang, M. Lei, H. Liu, Y. Zhou, and Q. Luo, “A novel robust zero-watermarking scheme based on discrete wavelet transform,” *Journal of* *Multimedia*, vol. 7, no. 4, pp. 303–308, 2012.
3. H. L. Dai and D. He, “An efficient and robust zero-watermarking scheme for audio based on DWT and DCT,” in *Proceedings of the Asia Pacific Conference on Postgraduate Research in Microelectronics and Electronics*, pp. 233-236, 2009.