ABSTRACT

The rapid growth of digital technology has led to security risks in the creation, sharing, and manipulation of digital images. Watermarking techniques have become an important method for protecting copyright and preserving authenticity, especially of digital images. However, existing watermarks often have problems in maintaining image quality and resilience to attacks. Therefore, a more effective approach is needed using the Robust Reversible Watermarking (RRW) technique. To improve watermarking performance in order to produce an optimal system in terms of imperceptibily, robustness, and capacity.

This research aims to develop a RRW image application by applying several proposed methods so that it can be accessed by various groups. The first proposed method is Polar Harmonic Transform (PHT)-based RRW with Logarithmic Quantization Index Modulation (LQIM) method. LQIM method works by using logarithmic-based quantisation to insert a watermark into a digital image. The second proposed method is PHT-based RRW with Multibit Spread Spectrum (MSS) method, which works by inserting multiple watermarks at once that have been mapped into a PN code. The third proposal is PHT-based RRW implemented on RGB images that work by separating RGB channels first and then selecting one of the three channels in RGB. The fourth proposal is RRW with an adaptive Spread Spectrum (SS) reversible method that works with SS amplitude using IWT or DWT wavelets.

The PHT method with LQIM is good against JPEG Quality Factor, AWGN, Gaussian attack, Median, Wiener, and Average Filter. This method has an average PSNR of 33.44 dB and BER of 0. PHT method with MSS is good against JPEG Quality Factor attack, noise (AWGN, Salt and Peppers, Speckle Noise), scaling, and Filtering. This method has an average PSNR of 36.18 dB and BER 0. PHT method on RGB image has PSNR 46.3158 dB and BER 0. This method is good against JPEG Quality factor, Gaussian Filter, and Speckle Noise. Adaptive Spread Spectrum (SS) method has PSNR 59.7116 dB and BER 0. This method is good against JPEG Quality factor and AWGN. Wmarks application shows good latency responsiveness and good CPU performance, and gets a SUS value of 80.35 with grade A, so it can provide an effective solution in protecting copyright and authenticity of digital images.

Keywords: Watermarking, Digital image, Reversible, Robust, Wmarks.