ABSTRACT

Holograms are globally accepted as the most advanced and reliable security device to fight against counterfeiting and forgery. Conventional security holograms, currently used for anti-counterfeiting, contain only fixed data and by using various techniques, look-alike holograms are created. This has resulted in lots of issues and authentication of holograms has become really essential. For higher-end security, there is great demand for machine-readable holograms with variable data content. Methods have been developed based on holographic data storage technology for producing machine-readable variable data micro-holograms. The variable data content offers additional security and the originality of each hologram can be verified and proved. In this thesis, design and development of a holographic variable data storage system for recording machine-readable micro-holograms is reported.

The advantages offered by the system are cost effectiveness and dry processing. The recording material used is Photopolymer that requires only dry processing. The recorded microholograms offer diffraction efficiency of about 60% in laboratory level measurements. No critical data regarding the security content of the hologram is to be disclosed to the public. The developed system incorporates Spatial Light Modulators (SLMs) for light modulation of variable digital data. Commercially available SLM costs more than Rupees 280 thousand and is not affordable. As an alternative, cost effective SLMs have been developed and the implementation details are
reported in this thesis. Since low cost SLMs based holographic data storage and verification devices developed by the investigator have been applied, the entire system has becomes very cost effective.

Design, development and testing of the entire new scheme was done and implemented successfully. A laboratory model of the Variable Data Photopolymer (VDP) micro-hologram writer and reader was fabricated and tested. The recorded holograms were processed and reconstructed using corresponding reference beams. The reconstructed data pages were grabbed using a CCD camera and processed in a computer using dedicated software and verified the originality. The system developed is expected to have much impact on product authentication, document security and secure transfer of critical data.